

**TECHNICAL MANUAL**

**OPERATOR, ORGANIZATIONAL,  
DIRECT AND GENERAL  
SUPPORT MAINTENANCE MANUAL  
HEATER, SPACE, MULTIFUEL, WITH  
BLOWER, 15,000 BTU / HR  
(HUNTER MODEL  
UH-48C, TYPE I)  
NSN 4520-01-010-0316**

This copy is a reprint which includes current  
pages from Change 1.

### **WARNING**

Death or serious illness may result from inhalation of exhaust fumes. The heat exchanger confines the combustion gases and directs this gas to the exhaust pipe. The exhaust pipe must be air tight to prevent harmful combustion products from entering the heated inclosure. Any crack or hole through the exchanger walls require exchanger replacement.

### **WARNING**

The space heater contains dangerous voltages which can cause severe electrical shock or death. Be extremely careful when making voltage measurements or other checks with the heater connected to the power source during troubleshooting. Always remove the power plug before making any continuity tests.

### **WARNING**

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (Fed. Spec. P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100F to 138F (38C to 59C).

CHANGE

No. 1

HEADQUARTERS  
DEPARTMENT OF THE ARMY  
WASHINGTON, D.C., 12 February 1987

Operator, Organizational, Direct and  
General Support Maintenance Manual

HEATER, SPACE, MULTIFUEL, WITH BLOWER,  
15,000 BTU/HR (HUNTER MODEL UH-48C, TYPE I)  
NSN 4520-01-010-0316

TM 5-4520-239-14, 15 December 1975, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages

i and ii  
1-1 and 1-2  
3-1 and 3-2  
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4-3 through 4-6  
A-1/A-2

Insert pages

i and ii  
1-1 and 1-2  
3-1 and 3-2  
3-2.1/3-2.2  
4-3 through 4-6  
A-1/A-2

2. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR.  
*General, United States Army*  
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No. 5-4520-239-14

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DEPARTMENT OF THE ARMY  
WASHINGTON, DC, 15 December 1975

**OPERATOR, ORGANIZATIONAL, DIRECT AND  
GENERAL SUPPORT MAINTENANCE MANUAL**

**HEATER, SPACE, MULTIFUEL, WITH BLOWER, BTU / HR**

**(HUNTER MODEL UH-48C, TYPE I)**

**NSN 4520-01-010-0316**

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## CHAPTER 1

### INTRODUCTION

#### Section I. GENERAL

##### 1-1. Scope

This manual is for your use while operating and maintaining Heater, Space, Multifuel with Blower, 15,000 Btu/hour (3780 kg-c), 120 vac, 50/60 Hz, single phase (Hunter Model UH-48C, Type I). You are instructed to perform the maintenance allocated by the Maintenance Allocation Chart.

##### 1-2. Maintenance Forms and Records

Maintenance forms and records that you are required to use are explained in DA PAM 738-750.

##### 1-3. Reporting of Errors

You can improve this manual by calling attention to errors and by recommending improvements. Your letter, DA Form 2028 (Recommended Changes to Publications), and DA Form 2028-2 (Recommended Changes to Equipment Technical Manuals) may be used. Copies of DA Form 2028-2 are attached in the back of the manual for your use. Please mail your recommended changes directly to: Commander, U.S. Army Troop Support Command, ATTN: AMSTR-MCTS, 4300 Goodfellow Boulevard, St. Louis, Mis-

souri 63120-1798. A reply will be furnished directly to you.

##### 1-4. Equipment Serviceability Criteria

This equipment is not covered by an ESC.

##### 1-5. Destruction of Army Materiel to Prevent Enemy Use

For specific instructions regarding destruction of equipment to prevent enemy use, refer to TM 750-244-3.

*a. Authorization.* The authority for ordering the destruction of the space heater is to be vested in the divisional and higher Commanders, who may delegate authority to subordinate Commanders, when the situation requires it.

*b. Mechanical Destruction.* Using an axe, pick, mattock, sledge hammer, or any heavy implement, damage all vital elements such as the carburetor, electric motor, blower, electrical controls, and burner head.

*c. Destruction by Fire.* Puncture the fuel supply tank, and spread fuel over entire space heater and ignite.

#### Section II. DESCRIPTION AND DATA

##### 1-6. Description

###### NOTE

The dimensions and tolerances are given in U. S. measurements and metric measurements. All metric measurements are enclosed in parentheses.

*a. The Model UH-48C, Type I, Multifuel Space Heater is designed for heating enclosures at which a source of 120-vac, 50/60 Hertz electric power is available. It has a maximum output of 15,000 Btu (3780 kg-c) per hour at sea level and a measured output heating capacity of not less than 13,000 Btu (3276 kg-c) per hour at altitude of 10,000 feet (3048 m) at an ambient temperature of  $70 \pm 10$  F ( $21 \pm 5.6$  C). The heater is designed for floor or wall installation. The heater is controlled by a remotely mounted thermostat to maintain*

*the temperature of an enclosed space within the range of  $55$  to  $85$  F  $\pm 1\frac{1}{2}$  F ( $12.78$  to  $29.44$  C  $\pm 0.8$  C) up to its rated output.*

*b. The heater is equipped with a removable discharge louver for directing the outlet air. A screened air inlet opening provides for entry of circulating air. Combustion air is provided by a separate impeller assembly and enters the heater through an opening at the rear of the heater.*

*c. The heater is equipped with a timed ignition control for safe starting without continuous operator supervision. A safety control will shut off the power if ignition does not occur within a preset time, minimizing risk of fire or explosion and protecting the unit from damage in the event of equipment malfunction or loss of fuel.*

d. Once the heater is in full operation, an additional safety control will shut off the flow of fuel if the unit reaches a preset overheat temperature.

e. The maintenance paragraphs of this manual contain detailed descriptions of heater components.

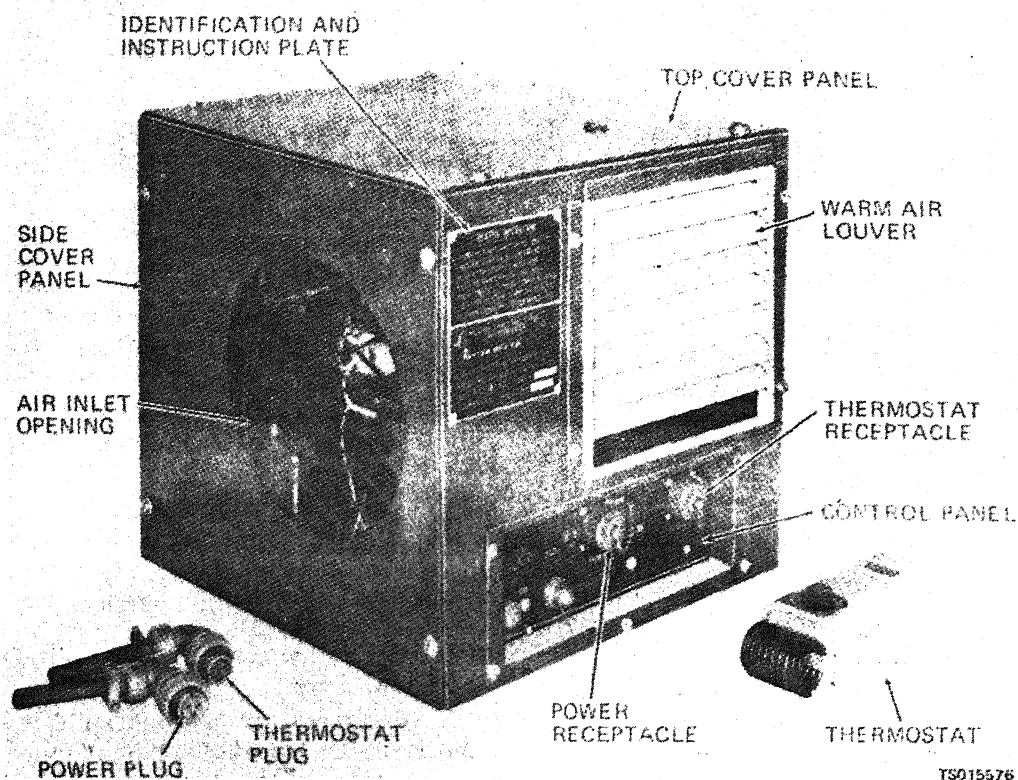


Figure 1-1. Model UH-48C, Type I, Multifuel Space Heater, left front, three-quarter view.

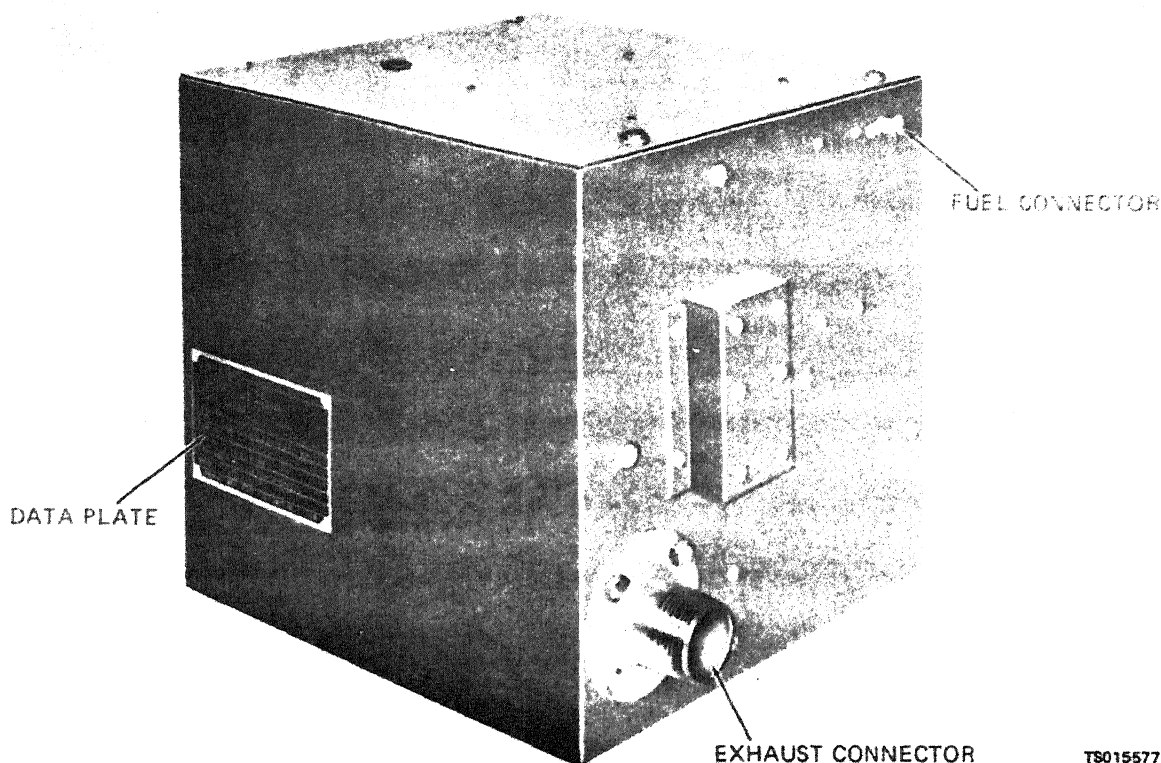


Figure 1-2. Model UH-48C, Type I, Multifuel Space Heater, right rear, three-quarter view.

### 1-7. Differences in Models

This publication covers only Heater, Space, Hunter Manufacturing Company Model UH-48C, Type I, serial numbers 7700 through 7845. No known unit differences exist for models in this serial number range.

### 1-8. Identification and Tabulated Data

*a. Identification.* The heater has three major identification plates, as follows:

(1) The U.S. Government data plate (figure 1-2) lists information regarding the model, serial number, national stock number, contract

number, dimensions, weight, cubage and other pertinent data.

(2) The wiring diagram plate is mounted on the inside of the solid cover removable panel of the heater. This plate shows an electrical schematic and a wiring diagram for the heater.

(3) The identification and instruction plate (fig. 1-1) provides abbreviated operating instructions and identification of the heater.

*b. Tabulated Data.* Tabulated data applicable to the space heater and its components is given in table 1-1.

*c. Wiring Schematic.* Refer to figure 1-3.



Table 1-1. Tabulated Data

Component	Data
Manufacturer	Hunter Manufacturing Company
Model number	UH-48C, type I
Volts	120 vac
Frequency	50/60 hertz
Current draw	50 hertz 60 hertz
Cold weather start	3.9 amps 3.7 amps
Normal start	3.3 amps 3.1 amps
Run	1.9 amps 1.7 amps
Fuel output	15,000 (3780 kg-c)
Description	Heater, space, multifuel with blower
Overall dimensions and weight	
Height	12 in. (30.48 cm)
Width	12 in. (30.48 cm)
Depth	13-3/4 in. (34.93 cm)
Weight	40 lb (18.14 kg)
Fuel pump	
Manufacturer	Bendix
Part number	MS51321-2
Type	Electric
Voltage	24 vdc, negative ground
Carburetor	
Manufacturer	Hunter Manufacturing Company
Part number	A-48170-B
Fuel filter	
Manufacturer	Zenith Carburetor Division, Bendix Corporation
Military standard	MS-51086
Type	Strainer element
Flow plug	
Manufacturer	Vulcan Electric Company
Type	Cartridge heater
Power requirement	150 watts at 115 volts
Fuel preheat thermostat	
Manufacturer	Stevens Manufacturing Company
Catalog number	110047
Open temperature	55 ± 6 F (12.78 ± 3.33 C)
Close temperature	40 ± 6 F (4.44 ± 3.33 C)
Solenoid valve coil (fuel shutoff)	
Manufacturer	Hunter Manufacturing Company
Part number	48348-01
Voltage	24 vdc
Fuel pump fuse	
Manufacturer	Littlefuse, Inc.
Part number	312.500-3AG
Rating	1/2 amp, 250 volts
Main power fuse	
Manufacturer	Bussman Manufacturing
Part number	MDX-7
Rating	7 amps, 125 volts
Igniter plug	
Manufacturer	Hunter Manufacturing Company
Part number	2-48174-02
Ignition transformer	
Manufacturer	Hunter manufacturing Company
Part number	A-48319-B
Primary volts	115 vac
Secondary volts	5000 vac
Ignition suppression resistor	
Manufacturer	Erie Resistor Company
Part number	SK-2579-000
Type	Ceramic
Resistance	5000 ohms

Table 1-1. Tabulated Data—Continued

Component	Data
Thermocouple	
Manufacturer	General Controls Company, Inc.
Catalog number	G251A13
Thermocouple relay	
Manufacturer	Hunter Manufacturing Company
Part number	2-48458
Pilot duty rating	120 to 140 vac
Overheat thermostat	
Manufacturer	Stevens Manufacturing Company
Catalog number	A-542
Open temperature	$250 \pm 6$ F ( $121.11 \pm 3.33$ C)
Close temperature	$210 \pm 12$ F ( $98.89 \pm 6.67$ C)
Room thermostat	
Manufacturer	Penn Controls, Inc.
Part number	A19BAB-3
Pilot duty rating	120 vac
Range	35 to 95 F ( $1.67$ to $35$ C)
Blower motor	
Manufacturer	Hunter Manufacturing Company
Part number	2-48727-01
Volts	120 vac, 50/60 hertz
Rated rpm, full load	4600 rpm
Suppression capacitors (motor)	
Manufacturer	Cornell-Dubilier Electric Corp.
Part number	NFT-181
Capacitance	0.015 mfd, 250 vac
Control relay	
Type	2 PDT, type I
Electrical rating	10 amp, 24 vdc
Duty rating	Continuous
Military standard	MS27245-1



## CHAPTER 2

### OPERATING INSTRUCTIONS

#### WARNING

If equipment fails to operate, refer to troubleshooting procedures in Chapter 3.

### Section I. OPERATING PROCEDURES

#### 2-1. General

This section contains information and instructions for the personnel responsible for operating this spacer heater. The information includes starting and stopping procedures, and basic heater operation.

#### 2-2. Controls and Instruments

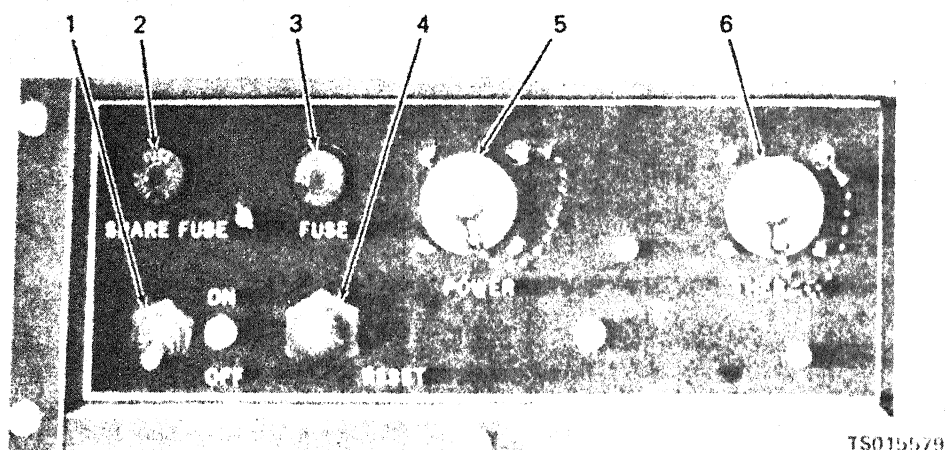
Before operating the heater, you must become familiar with the controls and instruments provided on the unit. Refer to table 2-1 for a description of control features. Refer to figure 2-1.

*Table 2-1. Controls and Instruments*

Fig. and Index No.	Name	Operation and use
2-1 1	ON-OFF switch	In the ON position, the switch causes the heater to start and run when heat is called for by the thermostat. When the switch is moved to the OFF position, the heater will stop. If the heater is running when the switch is moved to OFF, the heater will continue to run for a short time to purge the fuel from the burner. When purged, the heater will stop.
2-1 2	SPARE FUSE holder	Provides storage for a spare fuse to permit immediate restart of the heater if the fuse blows. To remove the fuse, press in the fuseholder knob and turn the knob a quarter turn counterclockwise.
2-1 3	FUSE holder	Contains the fuse connected into the operating circuit. To remove, press in the fuseholder knob and turn it a quarter turn counterclockwise. If fuse is defective, correct cause of defect and install spare fuse.
2-1 4	RESET switch	Press switch to restart heater after it stops due to ignition failure or lack of fuel.
NOTE		
2-1 5	POWER receptacle	Provides a connection to apply 120-volt, 50/60-hertz, single-phase ac power to the heater.
2-1 6	THERMO receptacle	Provides a connection to connect the room thermostat into the operating circuit of the heater.
2-2 1	Thermostat knob	Provides a means of selecting temperature which heater is to maintain in the enclosure. Rotate knob until required temperature is aligned with index mark.

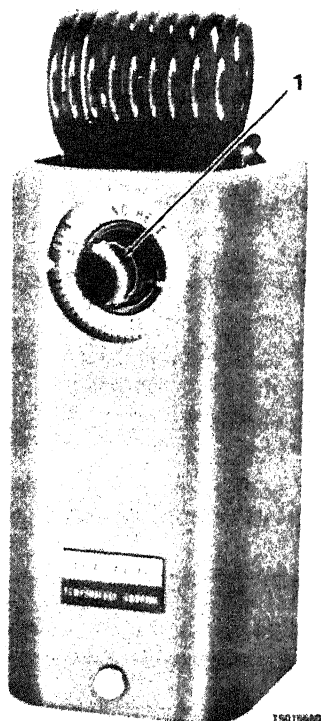
#### NOTE

The thermostat provides only an on-off control of the heater. Raising the thermostat setting does not increase the heat output of the heater per unit of operating time. It merely causes the heater to run longer to satisfy the heat demand. Setting the thermostat to the highest setting at startup does not increase the rate at which the desired temperature will be reached. To prevent heater overshoot, set the thermostat only to the temperature desired for the enclosure.



- |                      |                      |
|----------------------|----------------------|
| 1. ON-OFF switch     | 4. RESET switch      |
| 2. SPARE FUSE holder | 5. POWER receptacle  |
| 3. FUSE holder       | 6. THERMO receptacle |

Figure 2-1. Heater controls, fuses, and connectors.



1. Thermostat knob

Figure 2-2. Room thermostat.

## 2-3. Starting

### a. Preparation for Starting.

(1) Perform the before-operation preventive maintenance checks and services given in table 3-1.

(2) Check the setting of the thermostat knob (1, fig. 2-2). If necessary, readjust it to the required setting.

### b. Starting Procedures.

(1) Operate the ON-OFF switch (1, fig. 2-1) to ON.

(2) After a time delay the blower motor will start to run.

(3) Blower will circulate heated air in the enclosure.

(4) If heater stops after a short time, check for inadequate fuel supply. Replenish fuel supply. Allow short time for time delay mechanism to cool, then press RESET switch. Start heater in the normal manner.

## 2-4. Operation

a. After starting, the heater will run without operator control, cycling on and off under control of the thermostat.

b. If the temperature of the enclosure becomes too high or too low, adjust the thermostat knob (1, fig. 2-2) to compensate.

c. If the type of fuel being used is changed

om one operating period to the next, the heater may smoke or operate erratically. Report the condition to organizational maintenance.

#### 5. Stopping

- a. To stop the heater, turn the ON-OFF switch, fig. 2-1) to OFF.

#### CAUTION

Do not disconnect the power plug or interrupt the electrical supply to the

heater until it shuts down when the purge cycle is completed.

- b. If the heater is operating at time of shutoff, the fuel pump and ignition circuit are deenergized but the blower motor will continue to run and the burner will continue to burn until all fuel is purged from the heater. When the fuel is burned and the heater has cooled sufficiently, the heater will shut down.

## Section II. OPERATION UNDER UNUSUAL CONDITIONS

### 6. Operation in Extreme Cold (Below 10F) (-12.2 C)

A fuel heater, located in the carburetor assembly, is energized by a disc-type thermostat when the temperature drops below  $30 \pm 5$  F ( $-1.11 \pm 2.78$  C). The heater automatically preheats the fuel to aid combustion and ignition during extremely cold conditions. In addition, you should take the following steps during extremely cold conditions:

- a. Keep the fuel tank full to prevent condensation of moisture in the tank.
- b. Clean snow and ice from fuel tank filler to prevent them from entering fuel tank, causing freezing in fuel lines.

### 7. Operation in Dusty or Sandy Areas

- a. Protect heater from blowing dust and sand.
- b. Take care to prevent dust and sand from entering the fuel tank.

### 8. Operation Under Rainy or Humid Condition

- a. Wipe all accessible exposed areas frequently.

- b. Paint all chipped or scratched surfaces to prevent rust.

- c. Cover the heater when not in use.

### 2-9. Operation in Salt-Water Areas

- a. Salt water will cause corrosion of all metal parts of the heater. Wipe the unit with a clean cloth dampened with fresh water and dry thoroughly.

- b. Repaint or touch up chipped and peeled paint as required to protect exposed metal surfaces.

### 2-10. Operation at High Altitudes

- a. The heater is designed to operate at elevations up to 10,000 feet (3048 m) above sea level without special service or adjustment.

- b. At 10,000-foot (3048 m) altitude, heat output may be reduced approximately 15 percent. This is a normal condition which cannot be prevented, but optimum performance can be obtained by following all service instructions carefully.

## CHAPTER 3

### OPERATOR / CREW MAINTENANCE INSTRUCTIONS

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#### Section I. LUBRICATION INSTRUCTIONS

There is no lubrication required to maintain the space heater.

#### Section II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

##### 3. General

To ensure that the space heater is ready for operation at all times, it must be inspected systematically so that defects may be discovered and corrected before they result in serious damage or failure. The necessary preventive maintenance services to be performed are listed and described in table 3-1. Defects discovered during operation of the unit shall be noted for future correction, to be made as soon as operation has ceased. Stop operation immediately if a deficiency is noticed which would damage the equipment if operation were continued. All deficiencies and shortcomings must be recorded, together with the corrective

action taken, on DA Form 2404 (Equipment Inspection and Maintenance Worksheet) at the earliest possible opportunity.

##### 3-2. Preventive Maintenance Checks and Services

###### NOTE

This heater does not require any lubrication. All bearings are permanently lubricated by the manufacturer.

Refer to table 3-1 for a tabulated listing of preventive maintenance checks and services which you must perform. The item number is listed and indicates the sequence of minimum requirements.

Table 3-1. Operator/Crew Preventive Maintenance Checks and Services

## NOTE

Within designated interval, these checks are to be performed in the order listed.

## B-Before

Item No.	Interval	Item To be Inspected	Procedures Check for and have repaired or adjusted as necessary	Equipment is Not Ready/ Available if:
	B			
1	●	Space Heater	<p>NOTE</p> <p>Keep outside of heater clean. Ensure the air inlet and outlet are free of obstruction.</p> <p>Make the following walk around checks.</p> <p>a. Check for fuel leaks and damaged fuel lines.</p> <p>b. Check external electrical connections for proper installation and tightness.</p>	Any fuel leakage is found.
			<p>NOTE</p> <p>During starting and operating check for leaks and loose or cracked parts. Check for unusual noise and excessive vibration. Check for improper or excessive cycling, smoking exhaust, improper combustion, or any indication of a failing or defective component. If suspected, notify organizational maintenance.</p>	

### Section III. TROUBLESHOOTING

#### 3-3. General

a. This section contains troubleshooting information for locating and correcting most of the operating problems which may develop in the space heater. Each malfunction is followed by a list of tests or inspections which will help you to determine probable causes and corrective actions to take. You should perform the tests/inspections and corrective actions in the order listed.

b. This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed, or is not corrected by the listed corrective actions, notify your supervisor.

#### 3-4. Operator/ Crew Maintenance Troubleshooting

Refer to table 3-2 for troubleshooting which is allocated to operator/crew maintenance levels.

Table 3-2. Operator/Crew Troubleshooting

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
-------------	--------------------	-------------------

#### 1. HEATER FAILS TO START (NO FLAME, NO BLOWER).

Step 1. Check if power is connected to the heater.

Connect heater to a source of single-phase, 120-VAC, 50/60 Hz power. If no power is evident, notify organizational maintenance personnel.

Step 2. Check that ON-OFF switch is in the ON position.

If ON-OFF switch is OFF, flip the switch to ON (1, fig. 2-1.1). If heater still does not heat, notify organizational maintenance personnel.

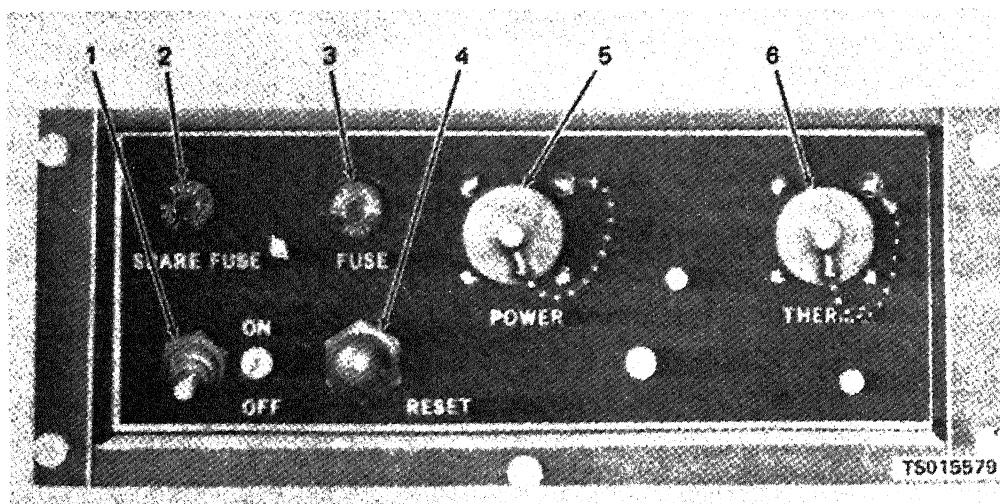


Figure 2-1.1. Heater controls, fuses, and connectors.

Step 3. Check room thermostat setting.

Thermostat setting must be higher than the air surrounding the heater in order to start heater operation. If heater does not operate, notify organizational maintenance personnel.

MALFUNCTION  
TEST OR INSPECTION  
CORRECTIVE ACTION

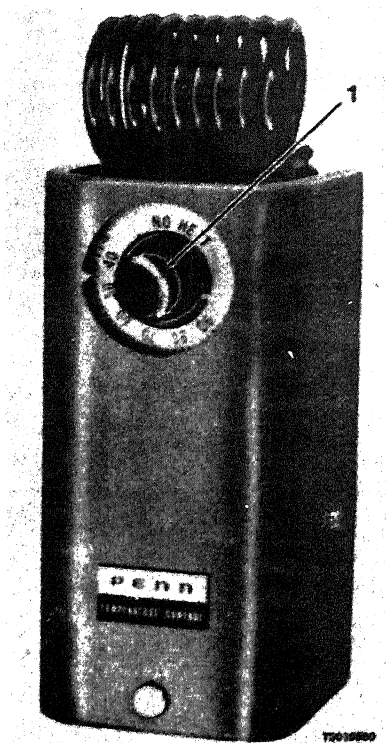


Figure 2-1.2. Room thermostat.

Step 4. Check RESET switch.

Press in RESET switch (4, fig. 2-1.1) to reset heater circuit. Start heater as follows:

With the ON-OFF switch in the ON position, and after a time delay, the blower motor will start to run. If blower motor will not run, notify organizational maintenance personnel.

**2. HEATER FAILS TO START (NO HEAT; BLOWER RUNS FOR SHORT TIME, THEN STOPS).**

Check if fuel tank contains fuel.

Fill fuel supply as required.

**3. HEATER OVERHEATS**

Check for airflow restrictions as follows:

- a. Clear area around heater of obstructions to allow free passage of air into and out of the heater (fig. 2-1.3).

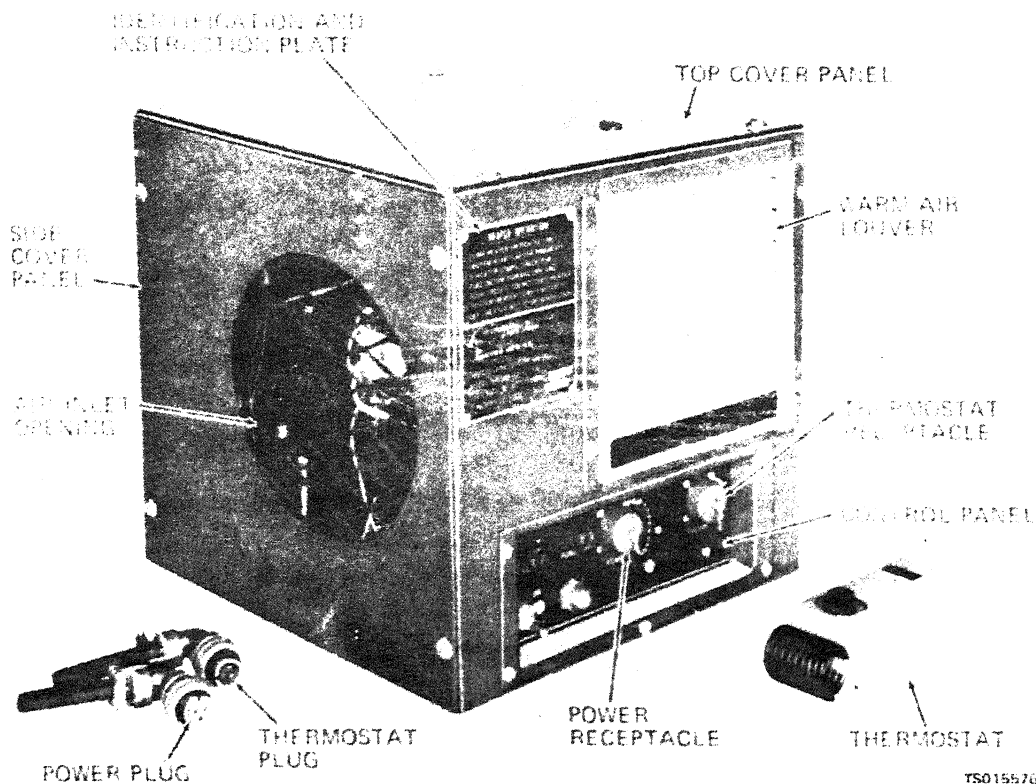


Figure 2-1.3. Model UH-48C, Type 1, multifuel space heater, left front, three-quarter view.

- b. Be especially careful not to obstruct the air inlet opening, and the warm air outlet louver (fig. 1-1.1).

## Section IV. MAINTENANCE PROCEDURES

### 3-5. Maintenance of Fuel Supply

a. The heater will operate satisfactorily on any gasoline conforming to Specification MIL-G-3056, VV-G-76, or any other gasoline (leaded or aromatic) of up to 100-octane grade. It will also burn diesel fuel which conforms to Specification VV-F-800, Class DF-1, DF-2, or DF-A, having a cloud point of not less than  $-55^{\circ}\text{F}$  ( $-48.4^{\circ}\text{C}$ ). Aircraft turbine fuels JP-4 and JP-5, conforming to Specification MIL-T-5624, will also operate on this heater.

b. During operation in extremely cold temperatures it is important to keep the fuel tank full to prevent condensation in the tank. Moisture in the tank can enter the heater fuel system and interfere with proper combustion, or can freeze in the fuel line, stopping the flow of fuel.

### 3-6. Maintenance of Fuel Lines

Check that the fuel lines and fittings between the fuel supply and the heater are not kinked, leaking, or otherwise damaged. Report leaks or other damage to organizational maintenance.



## CHAPTER 4

### ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

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#### Section I. SERVICE UPON RECEIPT OF MATERIEL

##### 4-1. Inspecting and Servicing the Equipment

a. Prepare the heater for inspection and operation as outlined on DA Form 2258, Depreservation Guide for Vehicles and Equipment.

b. Inspect the entire heater for lost parts or damage which may have occurred during shipment.

c. Inspect the controls for loose or missing hardware.

d. Inspect the thermostat for a broken or loose element.

e. Inspect all tubing, lines, and fittings to see that they are secure and free of breaks, kinks, and other damage.

f. Correct all deficiencies or report them to direct support maintenance.

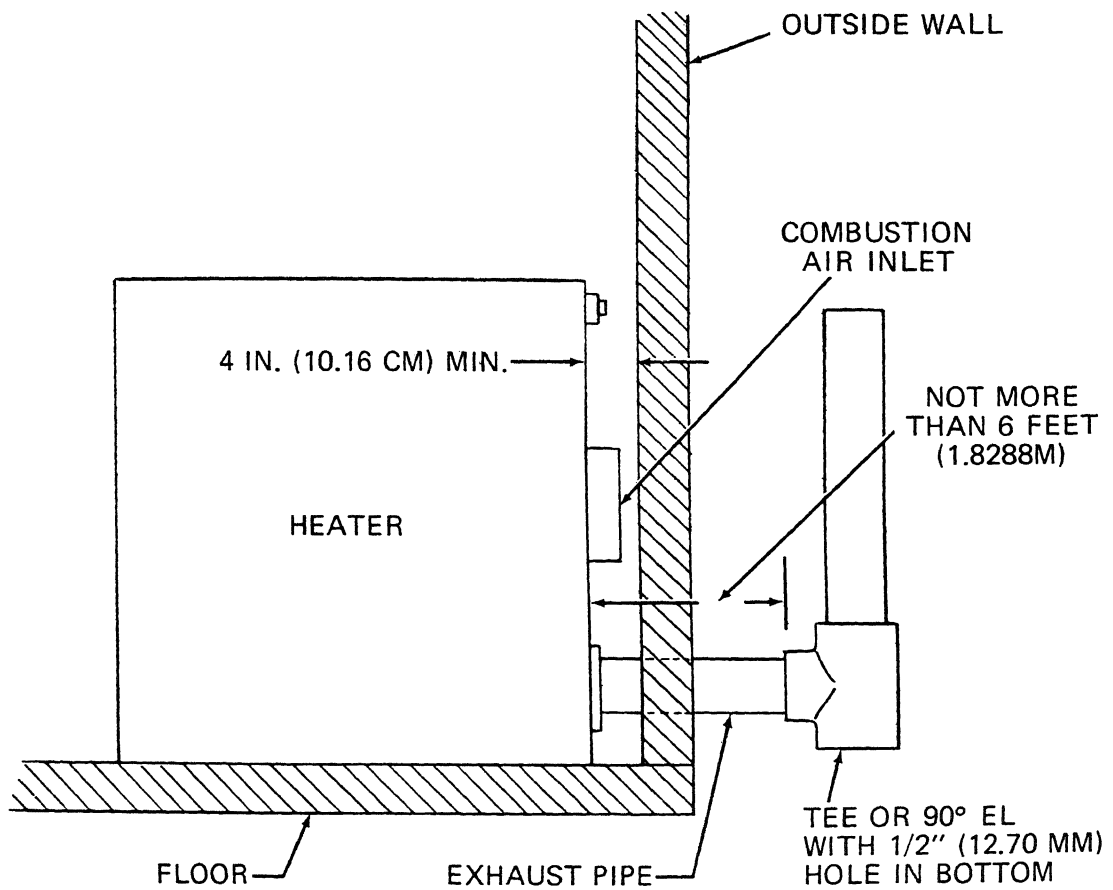
##### 4-2. Installation of Separately Packed Components

The room thermostat and the power and thermostat plugs are separately packed. For installation of these components, refer to paragraph 4-3.

##### 4-3. Installation or Setting Up Instructions

###### a. Location.

(1) Locate the space heater near an outside wall so that the exhaust can be piped to the outside with a short direct run (fig. 4-1). The total length of the horizontal run of the exhaust pipe must not exceed 6 feet (1.8288 m).



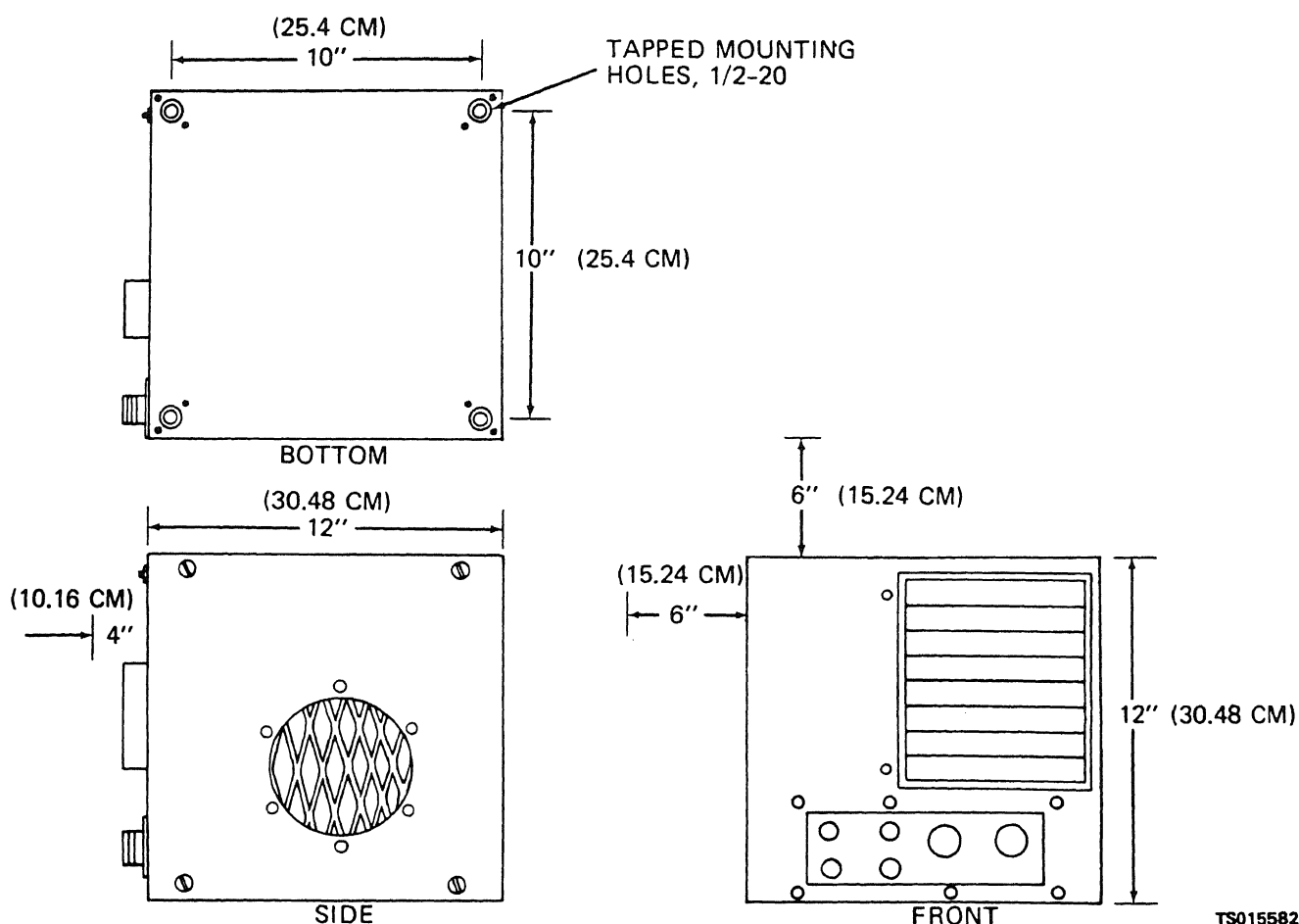
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Figure 4-1. Typical exhaust connection.

(2) The space heater must not be positioned more than 7 feet (2.1336 m) above the fuel source.

(3) Refer to the base plan (fig. 4-2) and

provide clearances as indicated to permit proper air circulation. Allow adequate room at the front for control access and servicing.



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Figure 4-2. Base plan.

(4) The side cover panel and the top cover panel are interchangeable to provide alternate air intake installation.

(5) The rain shield on the combustion air inlet is installed to provide a straight-through air connection for an external hose or pipe, or it can be inverted to provide an air flow opening at the bottom of the shield. Refer to figure 4-4.

*b. Installation.*

(1) Secure heater to base of floor using 1/2-20 bolts of suitable length (bolts not furnished with equipment).

(2) Connect the fuel connector on the heater to the fuel source, using suitable lines and fittings. Make sure that the fuel supply is clean and free of moisture. Check that connections do not leak.

**NOTE**

Fuel source must not be more than 7 feet (2.1336 m) below the heater.

(3) Connect a 1¼-inch exhaust pipe (not furnished with heater) from the exhaust connection on the heater to the outside (fig. 4-1). The exhaust line should be less than 6 feet (1.8288 m) long and contain as few bends as possible. Seal all exhaust pipe joints.

**WARNING**

Do not operate the heater in an enclosed space unless the exhaust gases are piped to the outside. Inhalation of exhaust fumes will result in serious illness or death.

**CAUTION**

During operation, the exhaust pipe becomes hot enough to cause combustion of wood or other flammable building materials. Provide adequate fireproofing insulation between the exhaust pipe and wall to prevent fire.

(4) Mount the room thermostat in an upright position on an inside or insulated wall in the area to be heated. Do not install the thermostat in line with the heater air inlet or discharge air flow, or in a drafty position.

(5) Remove the thermostat cover and attach to the thermostat a 3-wire cable (not furnished with heater) long enough to reach between heater and thermostat, securing the cable ground (green) wire to one of the thermostat mounting screws. Attach the other end of the cable to the male plug that is shipped separately. Make sure the ground wire of the cable is connected to the ground lug of the plug (pin B). Connect the plug to the room THERMO receptacle (6, fig. 2-1) on the heater control panel.

#### NOTE

If the combined length of power cable and thermostat cable does not exceed 20 feet (6.096 m), use 14-gage cable for both applications. If the combined length exceeds 20 feet (6.096 m), use 12-gage cable.

(6) Prepare the power cord using a 3-wire cable (not furnished with heater), an electrical connector (not furnished with heater) to mate with the power source receptacle, and the power plug provided with the heater. Connect the ground (green) wire of the cable to pin B on the heater power plug and to the ground terminal on the electrical connector. Connect the remaining two leads to the A and C pins of the power plug and to the other two terminals on the electrical connector.

## Section II. MOVEMENT TO NEW WORKSITE

### 4-4. Dismantling for Movement

a. Disconnect the fuel line from the fuel connector. Start the heater and allow it to run until it stops from lack of fuel. This will purge fuel from fuel lines.

b. Remove the thermostat and disconnect the thermostat and power cables from their receptacles on the control panel.

c. Remove, drain, and reinstall the fuel bowl of the fuel strainer.

d. Disconnect the exhaust pipe from the exhaust connector.

e. Remove the bolts securing the heater to the base or floor.

### 4-5. Reinstallation after Movement

Refer to paragraph 4-3 for installation instructions.

### 4-6. Reinstallation after Movement

Refer to paragraph 4-3 for installation instructions.

## Section III. REPAIR PARTS, SPECIAL TOOLS, AND EQUIPMENT

### 4-6. Tools and Equipment

The equipment issued with the heater assembly is illustrated in figure 1-1.

### 4-7. Special Tools and Equipment

No special tools or equipment is required for organizational maintenance of the heater assembly.

### 4-8. Maintenance Repair Parts

Repair parts and equipment are listed and illustrated in the repair parts and special tools list covering organizational maintenance for this equipment. Refer to TM 5-4520-239-24P.

## Section IV. PREVENTIVE MAINTENANCE CHECKS AND SERVICES QUARTERLY AND SEMIANNUALLY

### 4-9. General

This section lists the preventive maintenance checks and services which shall be performed on a quarterly or semiannually basis by organizational maintenance personnel. It includes and expands upon the preventive maintenance services performed by operator/crew maintenance and includes additional services which are allocated to organizational maintenance.

### 4-10. Preventive Maintenance Checks and Services

Consult table 4-1 for a listing of the preventive maintenance checks and services which are allocated to organizational maintenance.

Table 4-1. Organizational Preventive Maintenance Checks and Services

Item No.	Interval		Item to be Inspected	Procedures
	Q-Quarterly	S-Semiannually		
1	●		Heater Case	Disconnect power plug and remove top and side cover panels and warm air louver. Using a dry cloth, wipe dust, dirt, grease, fuel, and lint from inside and outside of heater case, cover panels, and louvers. Check all electrical connections, wiring, and electrical components for evidence of overheating or damage. Check fuel system for cracks, leaking connection, or damage. Check for loose connections and loose or missing hardware.
2	●		Fuel Filter	Remove and clean sediment bowl and filter.
3		●	Fuel Pump Filter	Remove and clean fuel pump filter.

## Section V. TROUBLESHOOTING

### 4-11. General

a. This section contains troubleshooting information for locating and correcting most of the operating troubles which are the responsibility of organizational maintenance. Each malfunction is followed by a list of tests or inspections which will help you to determine probable causes and corrective actions to take. Perform the tests /inspections and corrective actions in the order listed.

b. This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify your supervisor.

c. Only those functions which are solely within the scope of organizational maintenance are

listed. For troubleshooting procedures which are within the scope of operator/crew maintenance, refer to paragraph 3-4.

### 4-12. Organizational Maintenance Troubleshooting Chart

Refer to table 4-2 for troubleshooting which is allocated to organizational maintenance levels.

#### **WARNING**

The space heater contains dangerous voltages which can cause severe electrical shock or death. Be extremely careful when making voltage measurements or other checks with the heater connected to the power source during troubleshooting. Always remove the power plug before making any continuity tests.

*Table 4-2. ORGANIZATIONAL MAINTENANCE TROUBLESHOOTING*

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
1. HEATER FAILS TO START (NO FLAME, NO BLOWER).	Step 1. Check that main power fuse is not blown as follows:	a. Press in on fuse holder (5, fig. 4-10.1) and turn counterclockwise, then remove fuse holder with fuse.

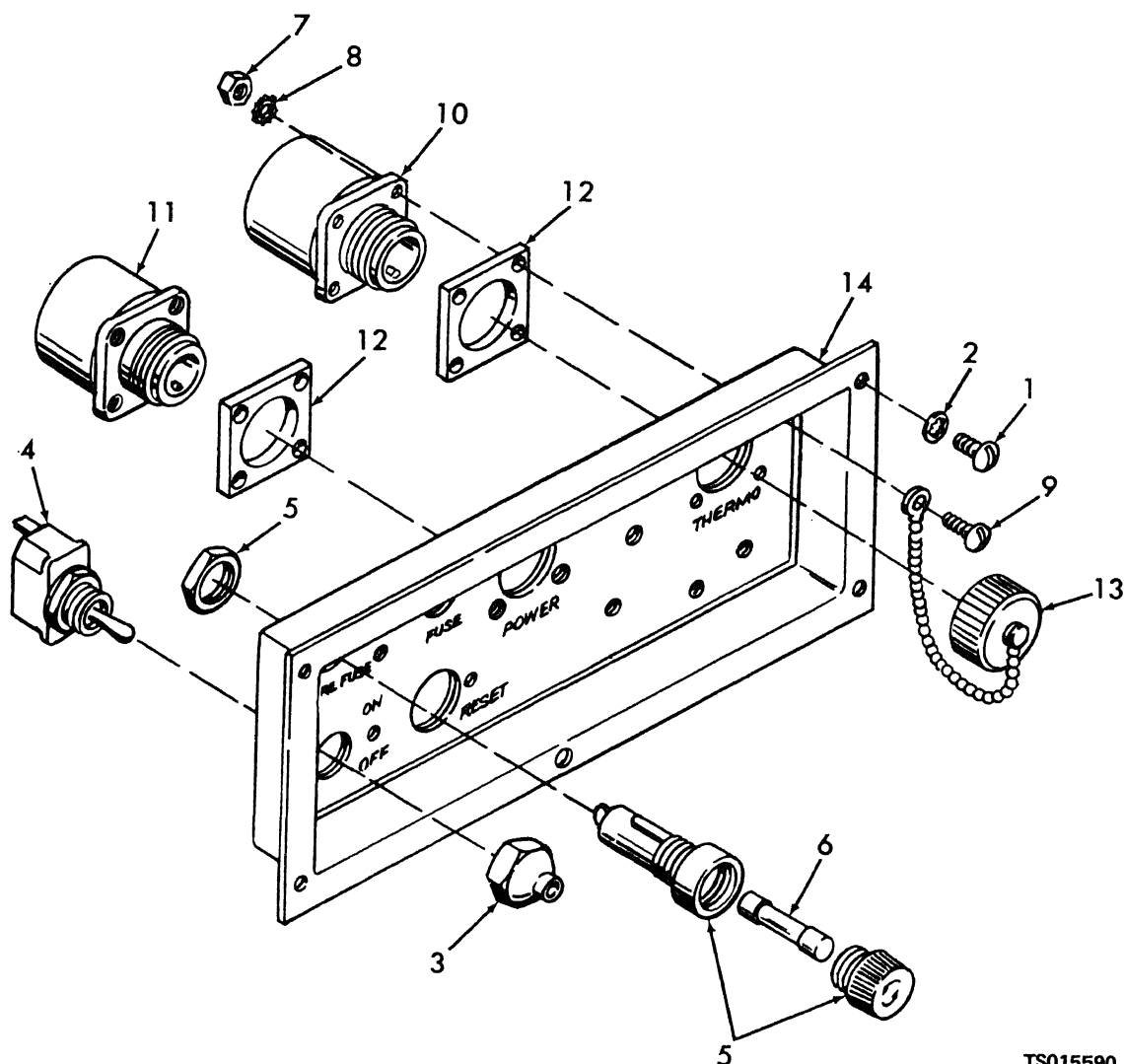


Figure 4-10.1. Control Panel, Exploded View.

- b. Pull fuse (6) out from fuse holder.
  - c. Make a continuity check using a multimeter. If there is no continuity indicated on the scale of the multimeter, discard defective fuse.
  - d. Install new fuse into fuse holder (5), then insert fuse holder with new fuse into fuse holder nut and press in and at the same time turn clockwise until it snaps into place (finger tight)
- the room thermostat wiring for loose connections or broken leads.
- Tighten loose connection and repair broken leads**

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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**WARNING**

The space heater contains dangerous voltages which can cause severe electrical shock. Be extremely careful while making t check.

Step 3. Position the power switch to ON. Set thermostat to its highest setting, remove cover and jump thermostat te using an insulated screwdriver.

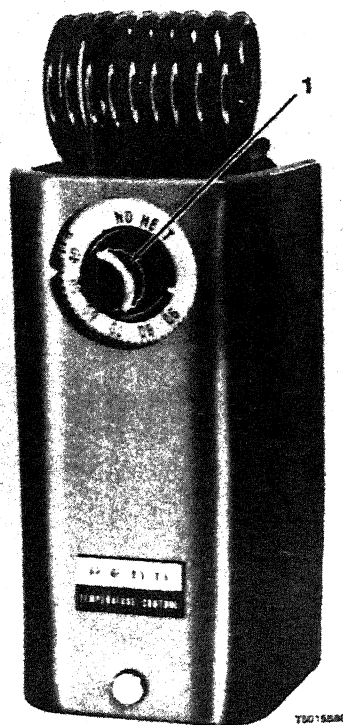


Figure 4-10.2. Room Thermostat.

Replace thermostat after the above test if heater starts as follows:

- a. Position ON-OFF switch to OFF. Remove thermostat plug from receptacle on control panel (6, fig. 4-10.3).



MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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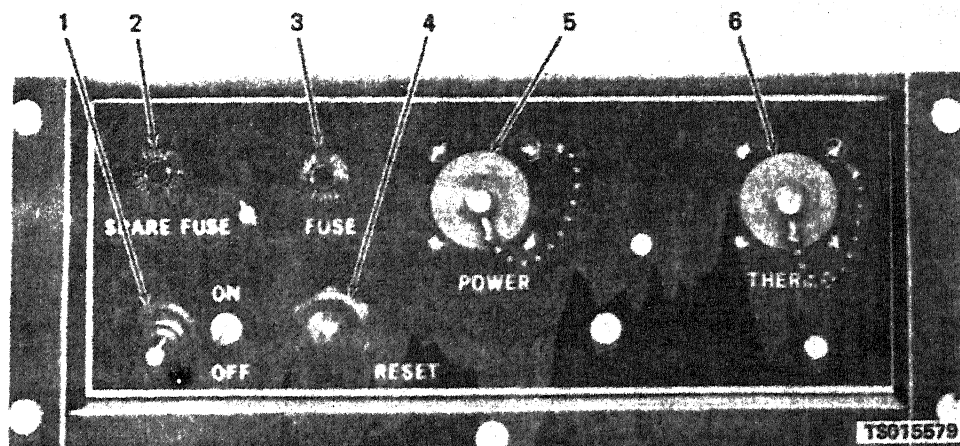


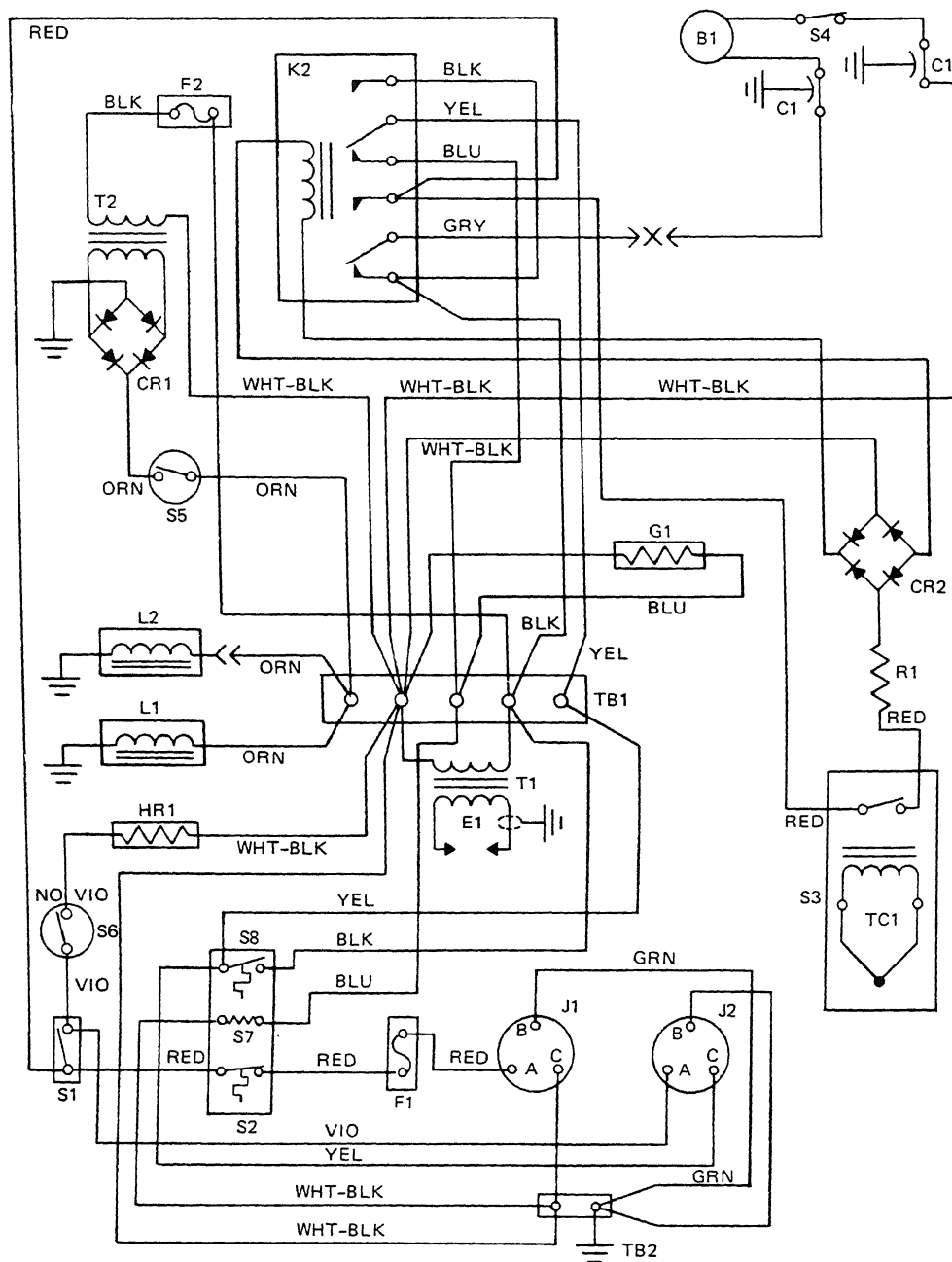
Figure 4-10.3. Heater controls, fuses and connectors.

- b. Tag terminals of the thermostat and disconnect leads of the thermostat cable, then set aside.
- c. Remove screws that secure thermostat to the wall, and discard defective thermostat.
- d. Replace new thermostat to the wall, and secure with screws. Connect thermostat cable leads to the previously tagged terminals.
- e. Plug in thermostat cable plug at the control panel, receptacle (6, fig. 4-10.3). Replace cover of thermostat.

Step 4. Check if ON-OFF switch is operational as follows:

- a. Remove five screws (1, fig. 4-10.1), and five lockwashers (2) securing the control panel (14) to the heater case. Pull out gently on the control panel to provide access to the wiring on the back of the control panel.
- b. Connect a jumper across ON-OFF switch. See wiring diagram (fig. 4-10.4), and apply power.

MALFUNCTION  
TEST OR INSPECTION  
CORRECTIVE ACTION



## KEY TO DIAGRAM

ITEM	KEY	ITEM	KEY	ITEM	KEY
VENT & COMB MOTOR	B1	RECEPTACLE POWER	J1	MOTOR PROTECTOR	S4
CAPACITOR	C1	RECEPTACLE THERMO	J2	SW. OVERHEAT THERMO	S5
RECTIFIER BRIDGE	CR1	RELAY DPDT	K2	SW. FUEL THERMO	S6
IGNITER	E1	VALVE SOLENOID	L1	TIMER HEATER	S7
FUSE	F1	FUEL PUMP NEG GRD	L2	SW. DELAY	S8
FUSE	F2	RESISTOR	R1	IGNITION XFMR	T1
GLOW PLUG	G1	SW. ON OFF SPST	S1	PUMP POWER XFMR	T2
HEATER FUEL BLOCK	HR1	HEATER RESET SW.	S2	TERMINAL	TB1
		SW. FLAME	S3	TERMINAL	TB2
				THERMOCOUPLE	TC1

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**MALFUNCTION****TEST OR INSPECTION****CORRECTIVE ACTION**

- c. Replace ON-OFF switch if heater starts as follows:
  - d. Position ON-OFF switch to OFF. Unsolder two red and two violet leads from the ON-OFF switch. See wiring diagram.
  - e. Unscrew boot (3, fig. 4-10.1) and remove the ON-OFF switch (4) from back of the control panel (14) and discard defective ON-OFF switch.
  - f. Install new ON-OFF switch on backside of control panel through hole, and secure with boot (3).
  - g. Use only rosin-core solder for all connections. Consult the wiring diagram (fig. 4-10.4) for correct wiring connection.
  - h. Reinstall the assembled control panel in the heater case and secure with five screws (1, fig. 4-10.1) and lockwashers (2).
- 2. HEATER FAILS TO START (NO HEAT; BLOWER RUNS UNTIL RESET SWITCH TRIPS).
  - Step 1. Check if fuel heater heats.
    - a. Jump fuel preheat thermostat, terminals (fig. 4-10.4). Position ON-OFF switch to ON.
    - b. Replace the fuel heater (21, fig. 4-10.5) if carburetor body (39) is not warm to touch after 30 to 45 seconds. Position ON-OFF switch to OFF.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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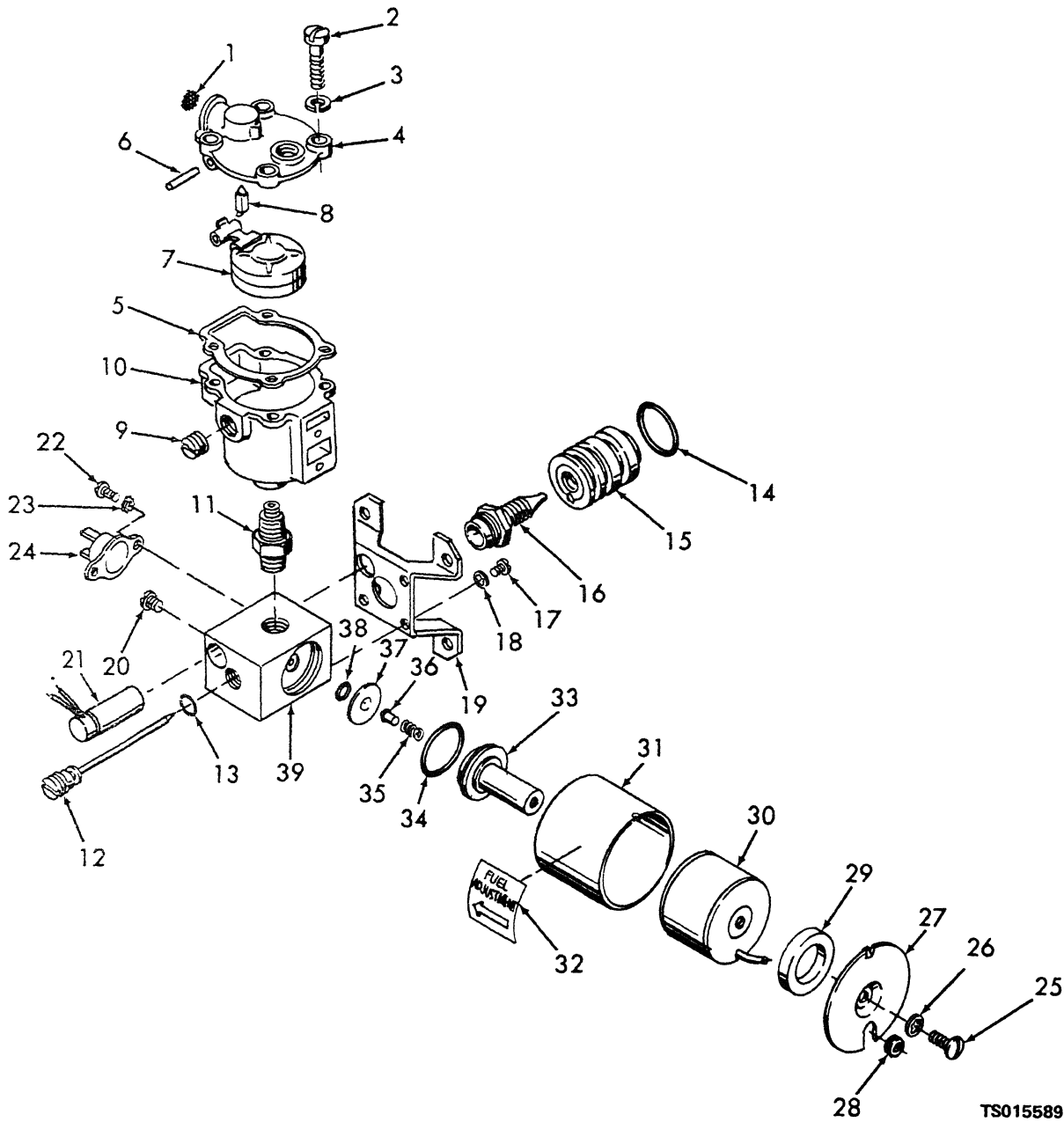
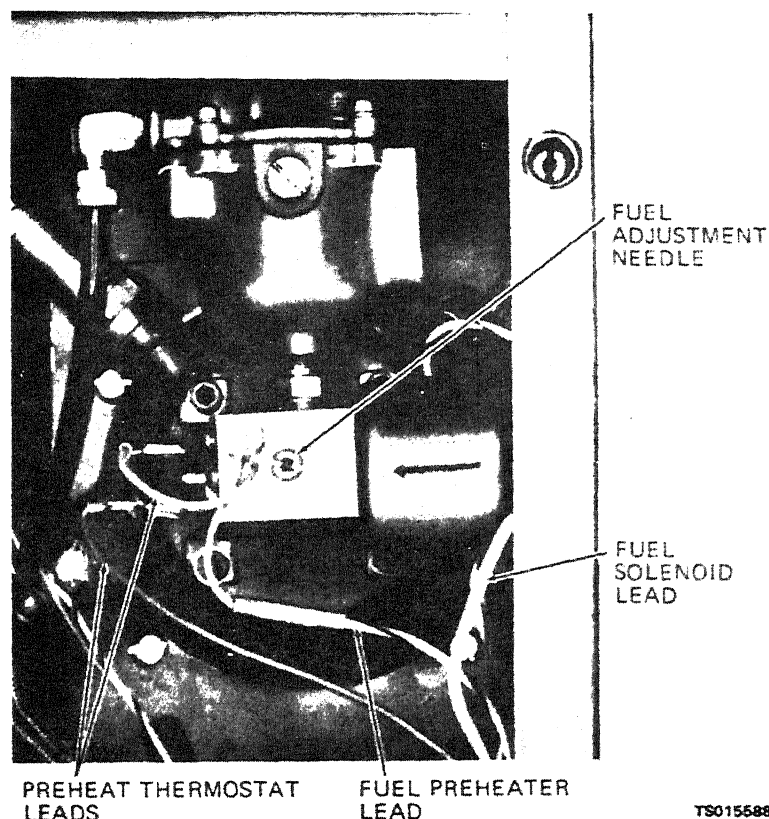


Figure 4-10.5. Carburetor, exploded view.

MALFUNCTION	
TEST OR INSPECTION	
CORRECTIVE ACTION	

- c. Remove preheat thermostat leads from the thermostat (24, fig. 4-10.5) and pull apart the fuel preheater lead at the quick disconnect (fig. 4-10.6).



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Figure 4-10.6. Carburetor fuel adjustment.

- d. Loosen screw (20, fig. 4-10.5), and slide fuel heater (21) out of carburetor body (39).  
 e. Test the fuel heater (21) for proper operation, by connecting the two fuel heater leads to a source of 120-volts. If fuel heater does not heat, replace the defective fuel heater.  
 f. Insert new fuel heater into carburetor body (39, fig. 4-10.5) and secure with screw (20).

NOTE

Do not tighten screw (20) too tight, (finger tight), as damage to the fuel heater will result.

Step 2. Check if the glow plug heats.

- a. Tag and disconnect the blue and white-black glow plug, leads from the terminal board (fig. 4-10.4), and unscrew and remove the glow plug (6, fig. 4-10.7), gasket (7) from burner head (8).  
 b. Apply 120-vac across the glow plug leads and check that glow plug heats. If glow plug does not heat, replace defective glow plug.  
 c. Install new glow plug (6) and gasket (7) in burner head (8).  
 d. Connect the blue and white-black glow plug leads to the previously tagged terminals of the terminal board.

Step 3. Check the fuel filter element for clogging as follows:

- a. Loosen the nut on the fuel filter bail. Swing the bail aside and remove the fuel bowl (1, fig. 4-10.8), gasket (2), and filter element (3) from fuel filter body (4).

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

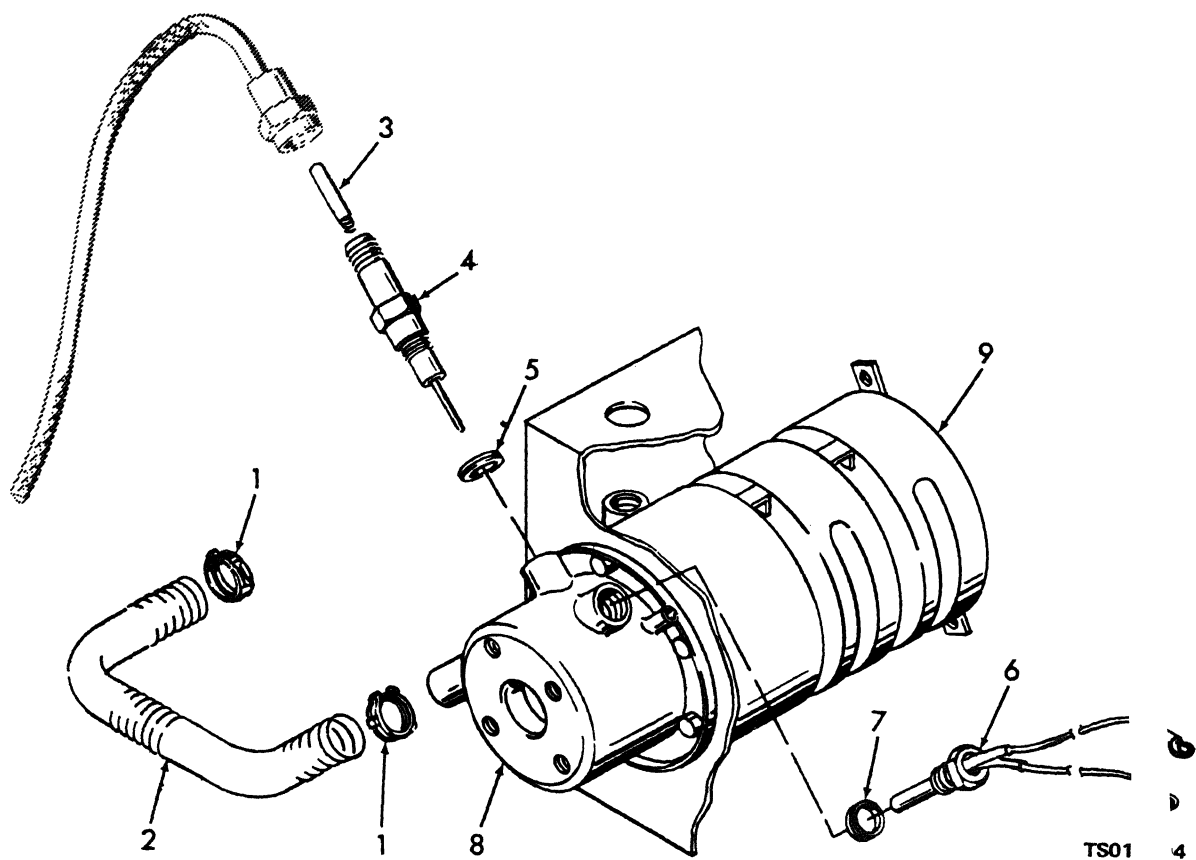
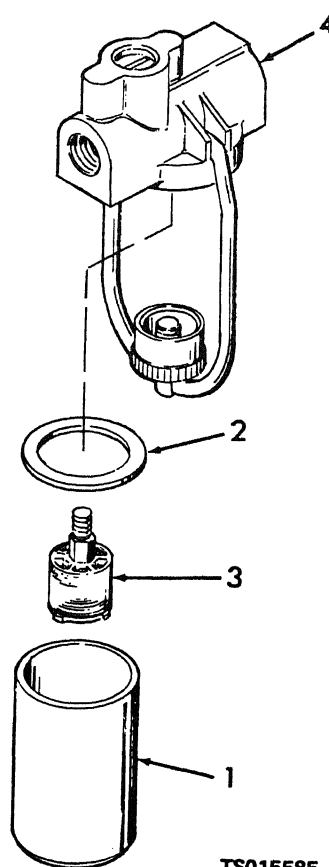


Figure 4-10.7. Burner head components (carburetor removed).

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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Figure 4-10.8. Fuel filter, exploded view.

**WARNING**

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (Fed. Spec P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38°C to 59°C).

b. Clean parts with dry cleaning solvent (Fed Spec. P-D-680) and allow all parts to dry thoroughly before reassembly.

c. Inspect fuel filter element for cracks (more than ½ inch (12.7000mm) long, or if dry cleaning solvent failed to clean the fuel element thoroughly. If the above inspection was unsatisfactory replace defective fuel filter.

d. Install new fuel filter element (3, fig. 4-10.8) in the fuel filter body (4).

e. Install the bowl (1), using a new gasket (2), and swing the bail in place. Engage the screw in the notch in the bottom of the bowl and tighten the nut hand tight.

Step 4. Check fuel pump filter is not clogged as follows:

**NOTE**

You can service the fuel pump filter without removing the fuel pump from the heater case.

**WARNING**

The space heater contains high voltages which can cause severe electrical shock. Be sure to disconnect the power plug before attempting to repair the space heater.

a. Disconnect the power plug (fig. 4-10.9) and shut off the fuel supply.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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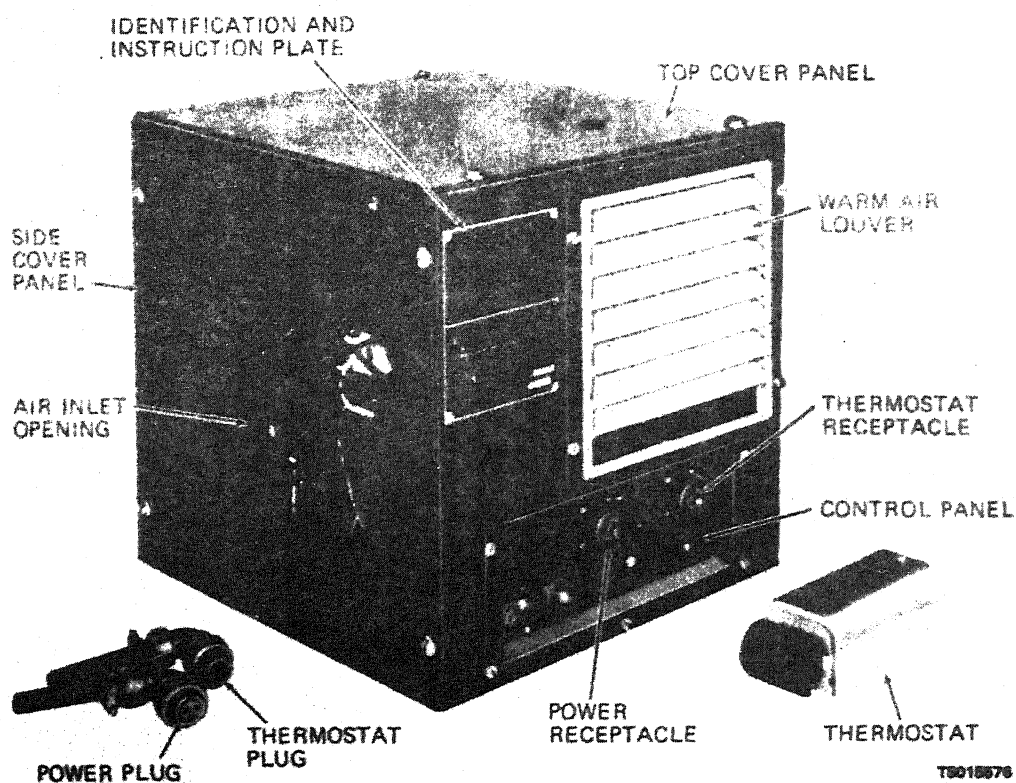


Figure 4-10.9. Model UH-48C, Type 1, Multifuel space heaters, left front, three-quarter view.

#### CAUTION

Use a rag or a container to catch fuel that will leak from pump when cover is removed.

- b. Remove the end cover (1, fig. 4-10.10) by fitting a 3/4 inch (19.0500 mm) wrench on the hex end of the fuel pump cover, and turn it counterclockwise, and remove cover, gasket (2), magnet (3) and fuel filter element (4) from the fuel pump (5).



MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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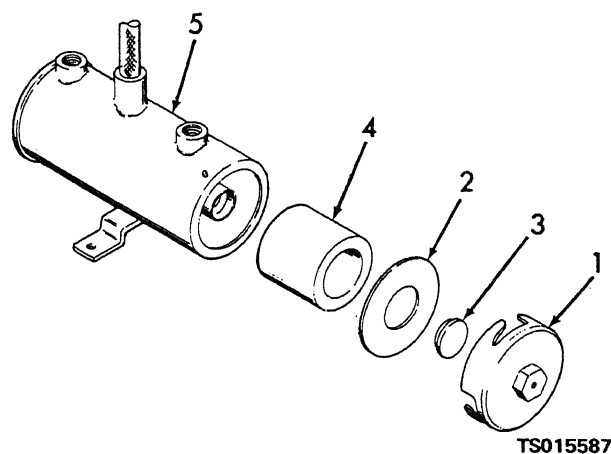


Figure 4-10.10. Fuel Pump Filter, Exploded View.

#### WARNING

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (Fed Spec P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38°C to 59°C).

c. Clean the parts with dry cleaning solvent (Fed. Spec. P-D-680) and allow all parts to dry thoroughly before reassembly. Replace fuel pump filter element if it cannot be cleaned with cleaning solvent, or if it has a crack more than  $\frac{1}{2}$  inch (12.7000mm) long. Wipe the magnet to remove any metal chips which stick to it.

d. Install the fuel pump filter element (4, fig. 4-10.0) in the fuel pump (5). Install the assembled cover (1), new gasket (2), and magnet (3). To install the fuel pump cover, use a  $\frac{3}{4}$  inch (19.0500mm) wrench on the hex end of the cover, and turn cover a quarter turn clockwise.

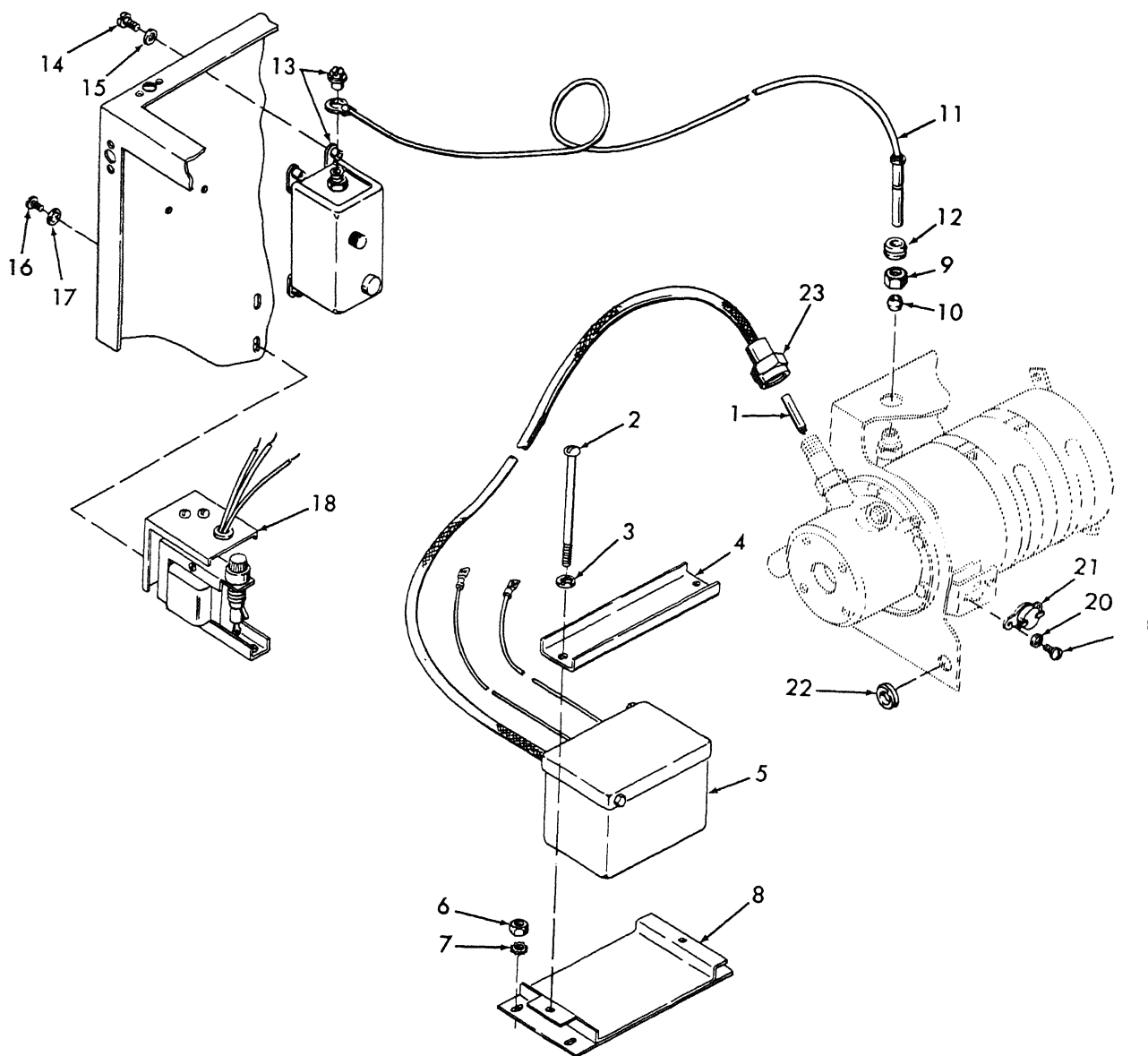
Step 5. Check proper operation of the overheat thermostat.

a. Tag and disconnect two orange leads from the overheat thermostat (see fig. 4-10.4).

b. Make a continuity test across the terminals at room temperature of  $250\text{F} \pm 6\text{F}$  ( $121.11\text{C} \pm 3.33\text{C}$ ). Replace thermostat if it is open below this temperature range, or if it is still closed above  $256\text{F}$  ( $124.44\text{C}$ ). When cooling, the thermostat must reopen at  $210 \pm 12\text{F}$  ( $98.89 \pm 6.67\text{C}$ ).

c. Remove two screws (19, fig. 4-10.11) lockwashers (20) securing the overheat thermostat (21) to bracket on the heat exchanger, remove the defective overheat thermostat.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION



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Figure 4-10.11. Electrical System Components, Exploded View.

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MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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d. Install new overheat thermostat (21) to bracket on heat exchanger, and secure with two lockwashers (2), (20), screws (19).

e. Install two orange thermostat to the overheat thermostat terminals (fig. 4-10.4).

Step 6. Check that 24-volt power is available to the fuel pump and fuel solenoid after time delay as follows:

a. Remove the fuel pump power supply fuse (18, fig. 4-10.11) by pressing down on the fuse holder, and at the same time turn counterclockwise. Pull fuse from fuse holder and using a multimeter make a continuity test. If there is no continuity indicated on the scale of the multimeter discard defective fuse.

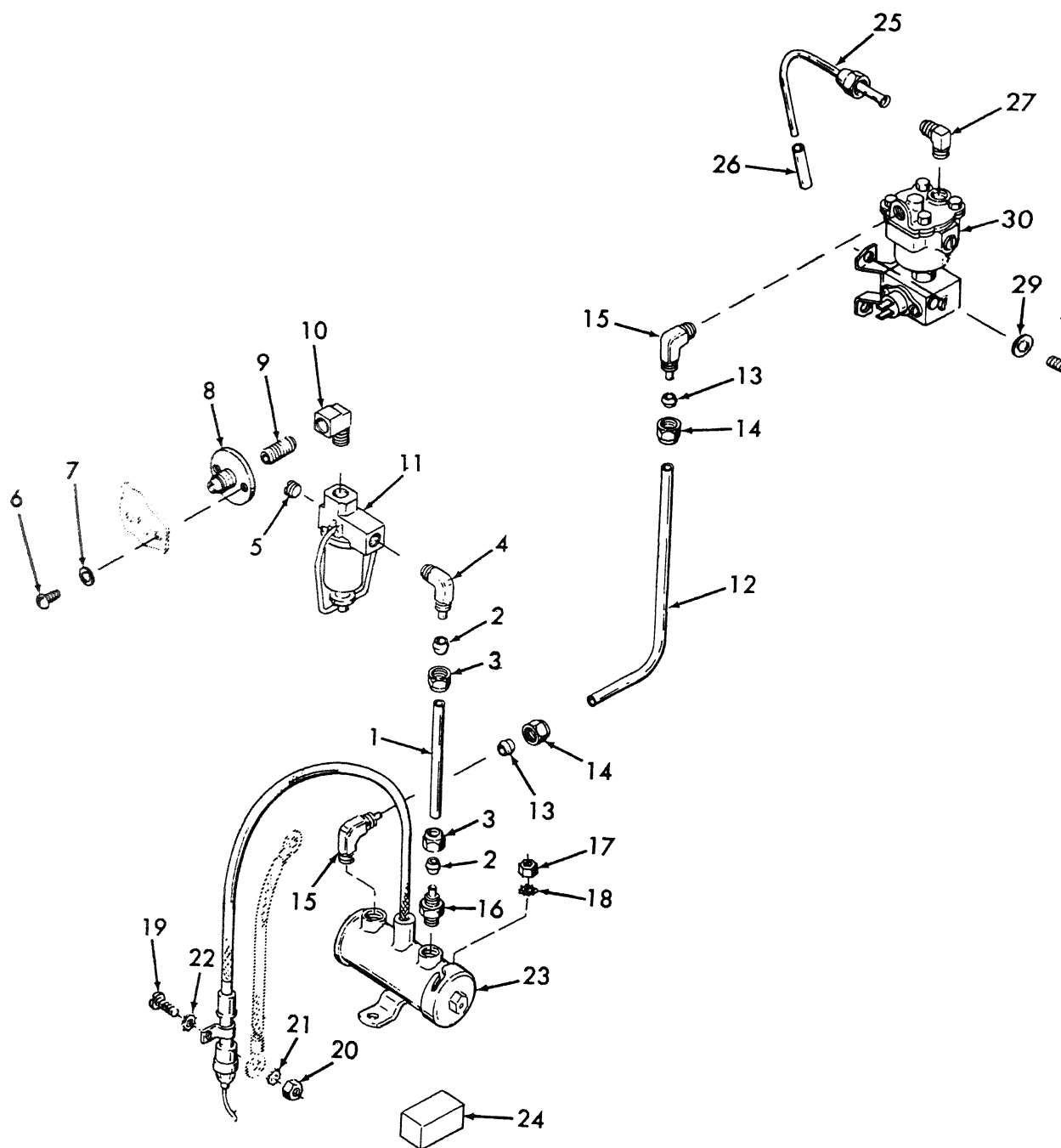
b. To replace new fuse insert it into the fuse holder, and install fuse with fuse holder into fuse holder retainer. Press down and at the same time, turn it clockwise until it snaps into place (finger tight).

c. Apply 115-volt, 50/60 hz alternating current across the black and white - black power supply leads and check dc voltage output across the orange lead and ground (fig. 4-10.4). Output must be 24-volts, If output is not 24-volts notify direct maintenance personnel.

Step 7. Check the power input to fuel pump as follows:

a. Disconnect the fuel tube at carburetor inlet (12, figure 4-10.12), and turn power on, then wait for time delay.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION



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Figure 4-10.12. Fuel System, Exploded View.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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- |  |  |  |
|--|--|--|
|  |  | b. Replace fuel pump if power is available but not fuel flows from fuel tube.<br>c. Shut off fuel supply. Disconnect the power plug.<br>d. Disconnect the assembled fuel tube (1 thru 3, fig. 4-10.12) from the elbow (4) at the fuel filter outlet and the fuel pump inlet.<br>e. Disconnect the assembled fuel tube (12 thru 14) from the fuel pump outlet and carburetor inlet. Remove elbow (15) and connector (16).<br>f. Remove screw (19), lockwasher (22) from heater case. Disconnect the fuel pump high tension cable at the connection.<br>g. Remove two nuts (17), lockwashers (18) from fuel pump bracket and remove defective fuel pump.<br>h. Connect the fuel tube (1 thru 3, fig. 4-10.12) to elbow (4) at the fuel filter outlet and the fuel pump inlet.<br>i. Install elbow (15) to fuel pump outlet and connector (16) to inlet of fuel pump. Connect fuel tube (12 thru 14) to elbow (15) and connector (16).<br>j. Connect high tension cable of fuel pump, and secure with lockwasher (22) and screws (19) to heater case. |
|--|--|--|

Step 8. Check input to ignition transformer as follows:

- |  |  |   |
|--|--|---|
|  |  | a. Remove nut from high tension cable (23, fig. 4-10.11) from igniter in burner head.<br>b. Hold high tension cable so that end is 1/8 inch (3.175mm) from a grounded surface. Position ON-OFF switch to ON, and wait for time delay, and note spark.<br>c. Replace ignition transformer if input is present but no spark jumps the gap.<br>d. Remove the suppression resistor (1) from the cable end.<br>e. Disconnect two igniter transformer power leads from terminal board (fig. 4-10.4).<br>f. Remove two screws (2, fig. 4-10.11), lockwashers (3) securing clamp (4) to bracket (8). Lift clamp (4) off igniter transformer (5) and set aside.<br>g. Remove and discard defective ignition transformer.<br>h. Install new ignition transformer (5) and position on bracket (8), then position clamp (4) on top and center of igniter transformer. Secure with two lockwashers (3), screws (2).<br>i. Install the two igniter transformer power leads to the terminal board (fig. 4-10.4).<br>j. Insert the suppression resistor into igniter and tighten high tension nut on igniter. |
|--|--|---|

Step 9. Check igniter for defects as follows:

- |  |  |   |
|--|--|---|
|  |  | a. Unscrew the nut on the ignition high tension cable and remove the high tension cable and the suppression resistor (3, fig. 4-10.7). Unscrew the igniter (4), and remove igniter and gasket (5) from the burner head. |
|--|--|---|

**WARNING**

Clean the parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (Fed Spec. P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100F to 138F (38C to 59C).

- |  |  |   |
|--|--|---|
|  |  | b. Inspect the igniter electrode and outer shell for burning or pitting. Inspect the ceramic parts for cracks not more than 1/4 inch (6.3500mm) long. Inspect the threads of igniter for damage. If more than one thread is damaged discard defective igniter, or if any of the above defects are found. Discard gasket (7).<br>c. Install new igniter (4) in burner head (8) using new gasket (7).<br>d. Insert suppression resistor (3) into igniter, and tighten nut of high tension cable on igniter (4). |
|--|--|---|

Step 10. Check if the suppression resistor is not open as follows:

- |  |  |  |
|--|--|--|
|  |  | a. Test the suppression resistor (3, fig. 4-10.7) using a multimeter. The resistance must be 4985 to 5050 ohms.<br>b. Replace the resistor if it is damaged (step 9 above) or if it is not within the limits as (a above). |
|--|--|--|

Step 11. Check oil if it is open as follows:

- |  |  |  |
|--|--|--|
|  |  | a. Test the solenoid coil (30, fig. 4-10.5) for continuity between the insulated lead and braided ground lead (fig. 4-10.4).<br>b. Replace the coil if it is open during test. If the coil insulation is deteriorated or shows signs of overheating, fuel saturation replace.<br>c. Remove screw (25, fig. 4-10.5) lockwasher (26) securing solenoid cap (27) to the carburetor body (39).<br>d. Push the grommet (28) from the slot in the cap to free the solenoid lead.<br>e. Remove the solenoid coil (30) from coil housing (31).<br>f. Install a new grommet (28) over the insulated solenoid coil lead and slide the grommet into the slot in the solenoid cap (27). Make sure the braided solenoid lead is centered over tapped hole in the core.<br>g. Install washer (29) if it is not damaged, and solenoid cap (27), then secure with lockwasher (26), screw (25). |
|--|--|--|

Step 12. Check for faulty carburetors as follows:

- |  |  |  |
|--|--|--|
|  |  | a. Remove fuel adjustment needle (12, fig. 4-10.5) and preformed packing (13) from the carburetor body (39).<br>b. Position ON-OFF switch to ON. Wait for time delay, and check that fuel flows from opening. If there is no indication of fuel flow replace carburetor. |
|--|--|--|

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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- |  |  |   |
|--|--|---|
|  |  | <ul style="list-style-type: none"> <li>c. Disconnect the power plug and loosen compression nut (14, fig. 4-10.12) from elbow (15) and remove assembled fuel tube (12).</li> <li>d. Unscrew and remove elbow (15) from carburetor (30).</li> <li>e. Loosen nut on overflow tube (25) from elbow (27). Remove elbow (27) from carburetor (30).</li> <li>f. Disconnect leads from preheat thermostat (24, fig. 4-10.5).</li> <li>g. Remove two screws (28, fig. 4-10.12), lockwashers (29) and remove and discard defective carburetor (30).</li> <li>h. Install new carburetor (30) with lockwashers (29) screws (28) and secure to heater core.</li> <li>i. Install elbow (27) on top of carburetor, and install compression nut on end of overflow tube (26).</li> <li>j. Install elbow (15) to outlet side of carburetor, and install fuel tube (12) to elbow (15) and secure with compression nut (14) at end of fuel tube (12).</li> </ul> |
|--|--|---|

3. HEATER IGNITES BUT BLOWER FAILS TO RUN.

Check if motor brushes are not worn less than 5/16 inch (7.937mm), burned or broken as follows:

- a. Disconnect the power plug and turn motor brush caps, counterclockwise and remove motor brushes.
- b. If motor brushes are worn as stated above, or if brushes show signs of being chipped or burned remove new brushes by inserting them into brush holder, and install motor brush cap, then turn clockwise until tight.

4. HEATER IGNITES BUT BLOWER SHUTS OFF AFTER A SHORT TIME.

Step 1. Check that thermocouple lead is not twisted or broken as follows:

- a. Visually inspect the thermocouple (11, fig. 4-10.1) to see if it is twisted or broken. If defective replace.
- b. Disconnect the power plug. Unscrew the compression nut (9, fig. 4-10.11) on end of the thermocouple (11) and pull up to remove it from the heat exchanger.
- c. Press out grommet (12) from hole in the heaterchanger housing and pull thermocouple free of the housing.
- d. Remove the screw on top of the thermocouple relay (13). Disconnect and remove the thermocouple from the thermocouple relay and discard.
- e. Install new thermocouple to thermocouple relay (13) and secure with screw.
- f. Insert grommet (12) into hole in heatexchanger housing.
- g. Insert element end of thermocouple through grommet (12) and secure with compression nut (10).

Step 2. Check the continuity of relay coil across inner and outer contacts as follows:

- a. Remove thermocouple from top of the thermocouple relay as shown in step 1 above.
- b. Make a continuity test across inner and outer contacts of the relay coil (fig. 4-10.4), by heating the thermocouple sensor using a cigarette lighter or small torch. There should be no continuity across the thermocouple relay terminals until the thermocouple sensor has been heated. No repair is possible to the thermocouple or thermocouple relay.
- c. Install new thermocouple relay as stated in Step 1, above.

5. HEATER OVERHEATS.

Step 1. Check for faulty motor brushes that cause slow motor and fan speed as follows:

Refer to item 3 above, (HEATER IGNITES BUT BLOWER FAILS, TO RUN).

Step 2. Check area around heater for restricted air flow as follows:

Remove all obstacles such as cans, books around outlet air passage, that cause restricted free air flow from the heater.

6. HEATER BACKFIRES.

Step 1. Check if fuel adjustment on carburetor is correct as follows:

**NOTE**

You can adjust the fuel adjustment needle without removing the side cover panel. Depending on which cover installed on the side of the heater. You can make the adjustment through the ventilation air inlet screen or through the access hole after removing the plug (2, fig. 4-10.13).

If heater operation is erratic; turn the fuel adjustment needle (fig. 4-10.6) 1/8 turn counterclockwise to increase fuel flow. Observe operation for 1 minute. Continue to turn the needle counterclockwise 1/2 turn at a time until heater operation is satisfactory. When heater is burning smoothly, there should be little or no smoke from the exhaust outlet.

Step 2. Check if ignition transformer is weak or intermittent spark jumps the gap as follows:

- a. Unscrew the cable nut (23, fig. 4-10.11) on the end of the ignition high tension cable, so that cable end is 1/8 inch (3.175mm) from a grounded surface.

**WARNING**

The space heater contains dangerous voltages which can cause severe electrical shock or death. Be extremely careful when making voltage measurements or other checks with the heater-connected to the power source during troubleshooting.

- b. Position ON-OFF switch to ON, wait for time delay and note spark.

c. Replace ignition transformer if weak or intermittent spark jumps the gap. Refer to item 2, step 8, HEATER FAILS TO START (NO HEAT; BLOWER RUNS UNTIL RESET SWITCH TRIPS).

Step 3. Check the exhaust system for obstructions.

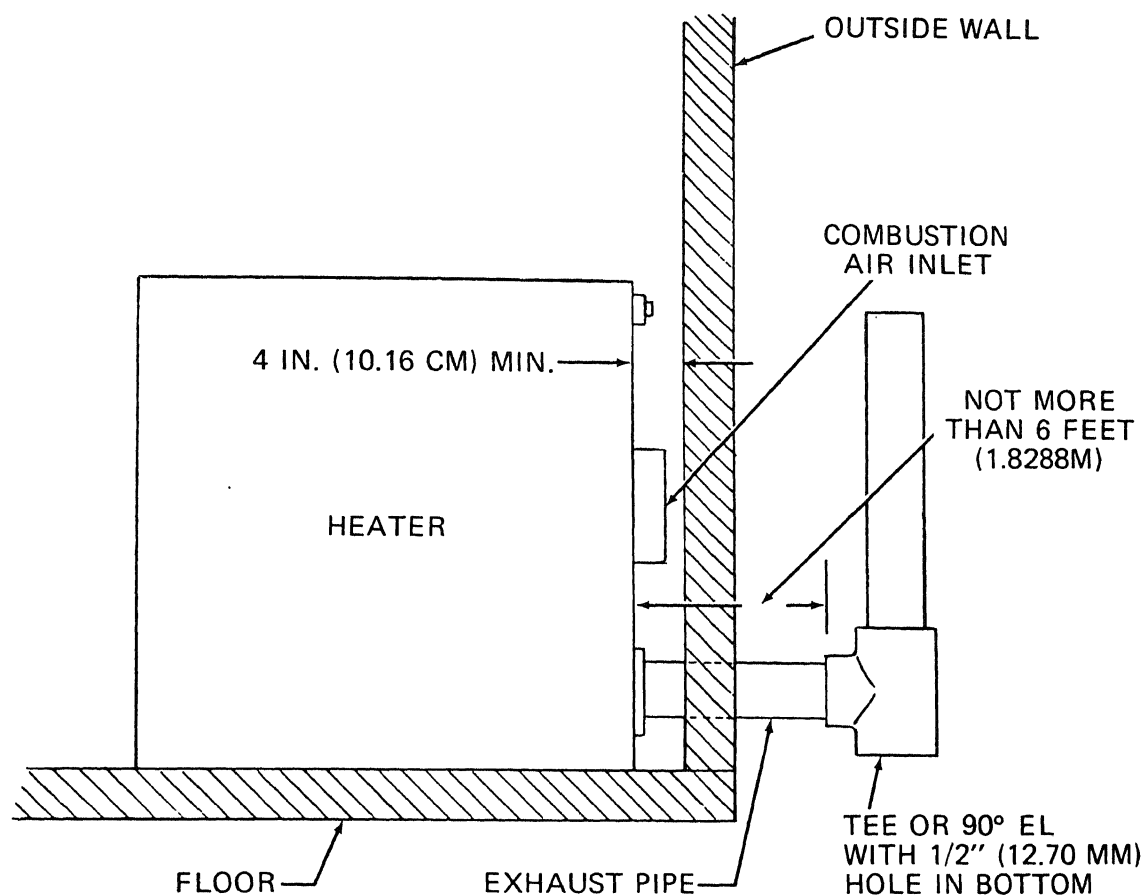
Refer to item 5. HEATER OVERHEATS (Step 2).

Step 4. Check if the exhaust piping is installed as shown in figure 4-10.13.

## MALFUNCTION

## TEST OR INSPECTION

## CORRECTIVE ACTION



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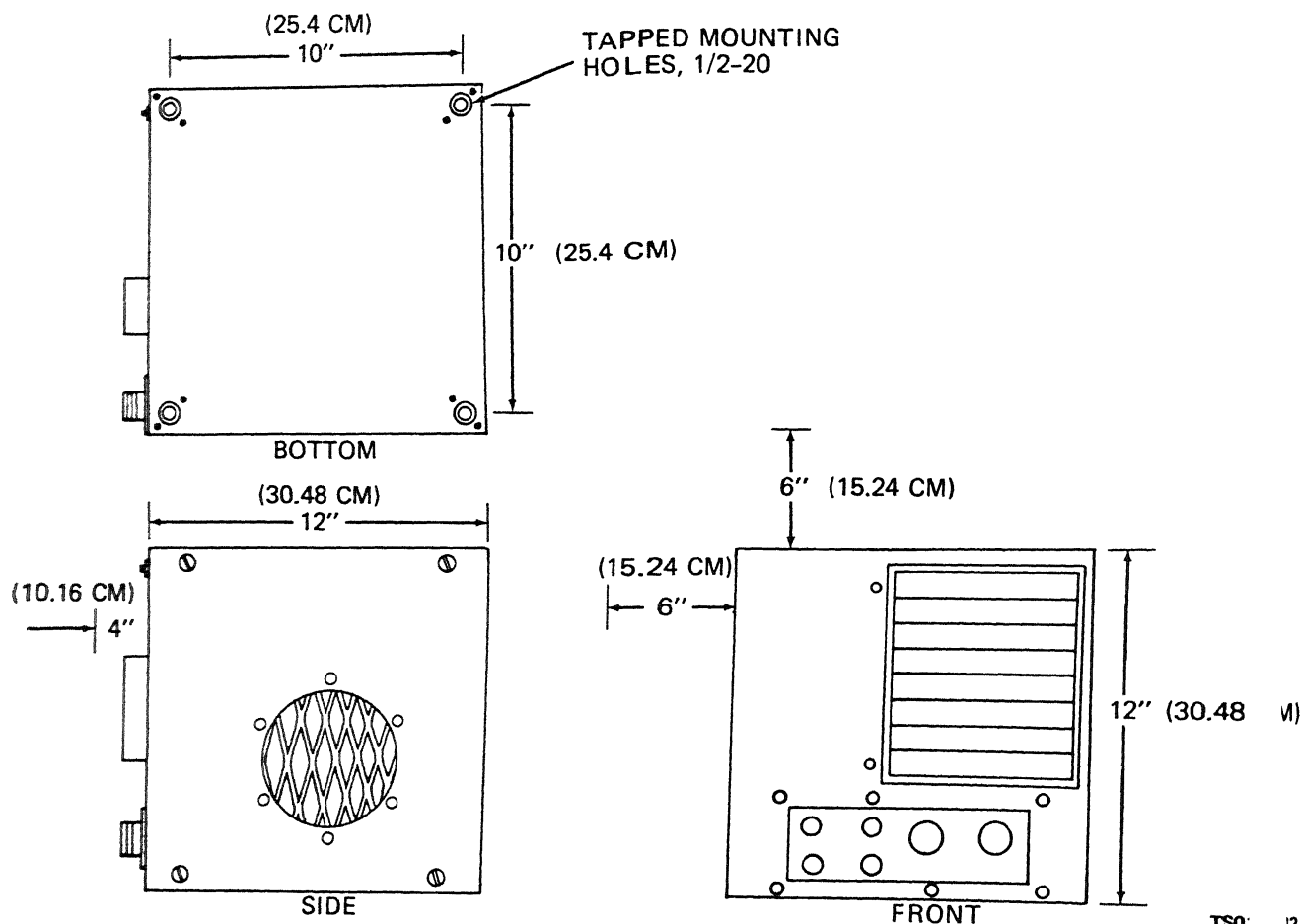
Figure 4-10.13. Typical exhaust connection.

## NOTE

Revise the exhaust piping to conform to the following:

1. Locate the space heater near an outside wall so that the exhaust can be piped to the outside with a short direct run (fig. 4-10.13). The total length of the horizontal run of the exhaust pipe must not exceed 6 feet (1.8288m).
2. The space heater must not be positioned more than 7 feet (2.1336m) above the fuel source.
3. Refer to the base plan (fig. 4-10.14), and provide, clearances to permit proper air circulation. Allow enough room at the front for control access and servicing.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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TSO 12

Figure 4-10.14. Base Pan.

**7. HEATER CYCLES ON AND OFF EXCESSIVELY.***Step 1. Room thermostat in wrong location.*

Mount the room thermostat (fig. 4-10.2) in an upright position on an inside or an insulated wall in the area to be heated, do not install the thermostat in line with the heater air inlet or discharge air flow or in a drafty position.

*Step 2. Check thermostat operation as follows:*

- Remove cover of room thermostat (fig. 4-10.2) tag and disconnect power cable from the room thermostat.
- Make a continuity test across room thermostat contacts while operating room thermostat temperature control (fig. 4-10.4).
- Replace room thermostat if contact operation is intermittent, or erratic as follows:
- Disconnect the room thermostat plug from heater THERMO receptacle (fig. 4-10.3).
- Remove cover from room thermostat. Disconnect the three leads from the terminals of room thermostat.
- Remove screws from room thermostat body secure it to the wall, and discard defective room thermostat.
- Remove cover from new room thermostat and set aside, leads from room thermostat terminals.
- Attach room thermostat to wall with the screws provided (fig. 4-10.2).



MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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		i. Connect two leads to the room thermostat terminals and one green (ground) lead to the remaining terminal (fig. 4-10.11). Replace cover of the room thermostat.
--	--	---

		j. Plug in room thermostat plug at the THERMO receptacle on control panel (fig. 4-10.3).
--	--	--

		k. Position ON-OFF switch to ON and check room thermostat operation.
--	--	--

#### 8. HEATER SMOKES.

Step 1. Check if fuel adjustment on carburetor is correct as follows:

##### NOTE

You can adjust the fuel adjustment needle without removing the side cover panel. Depending on which cover is installed on the side of the heater, you can make the adjustment through the ventilation air inlet screen on through the access hole after removing plug (2, fig. 4-4).

If heater smokes, turn fuel adjustment needle 1/8 turn clockwise to reduce the fuel flow (fig. 4-10.6).

Step 2. Check if combustion air inlet is not blocked or dirty as follows:

a. Loosen clamps (1, fig. 4-10.7) securing the combustion air hose (2) to the combustion air blower outlet and burner head, then blow out, using compressed air, or by shaking the combustion air hose.

b. If combustion air inlet hose is torn or restricted replace.

c. Install clamps (1) on each end of combustion air hose (2).

d. Connect hose to outlet of burner head (8), and secure with clamp. Install opposite end of hose to the tube on blower assembly, and secure with clamp.

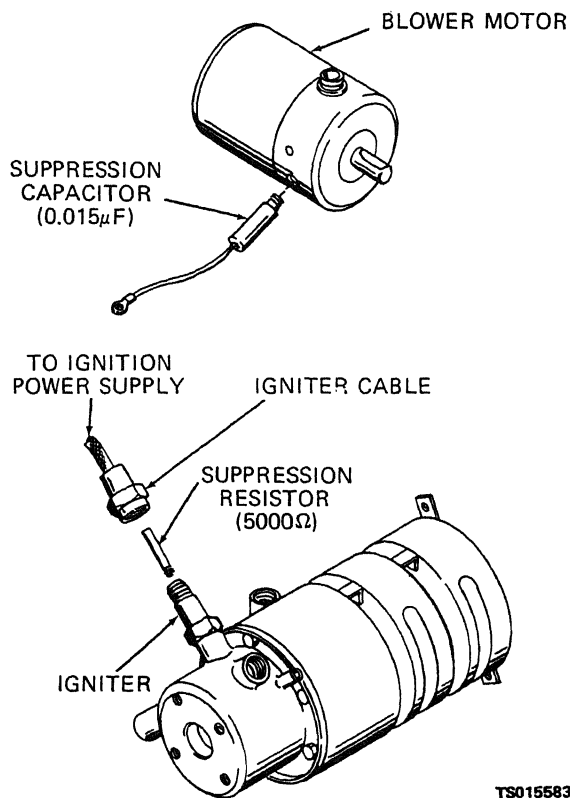
## Section VI. RADIO INTERFERENCE SUPPRESSION

### 4-13. General Methods Used to Attain Proper Suppression

Essentially, suppression is attained by providing a low resistance path to ground for stray currents. The methods used include shielding the ignition and high-frequency wires, grounding the frame through the electrical input cable and using capacitors and resistors.

### 4-14. Primary Interference Suppression Components

a. *Suppression Resistor.* A 5,000-ohm suppression resistor is contained in the end of the igniter cable from the ignition transformer to the igniter. (fig. 4-3.) This resistor suppresses radio interference generated by the high-frequency current flow to the igniter.



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Figure 4-3. Radio interference suppression components.

b. *Suppression Capacitors.* Two 0.015-microfarad capacitors are installed on the blower motor at the motor terminals. These capacitors suppress the radio frequency interference generated by the arcing of the brushes at the motor commutator.

#### 4-15. Replacement of Suppression Components

##### a. *Suppression Resistor.*

(1) Remove the side cover panel (fig. 4-4) for access to the igniter.

(2) Unscrew the nut on the high tension igniter cable, taking care not to pull on the cable or twist its braided wire shield.

(3) Remove the cable from the igniter and remove the suppression resistor from the end of the cable.

(4) Install a new suppression resistor in the cable end and install the assembled igniter cable and suppression resistor on the igniter.

(5) Tighten the igniter cable nut and replace the side cover panel.

b. *Suppression Capacitors.* Refer replacement of suppression capacitors to direct support maintenance.

#### 4-16. Secondary Interference Suppression Components

##### a. *Component Identification.* The secondary

suppression components on the space heater are - the shielded high tension cable from the igniter transformer to the igniter, and the motor ground strap from the motor mount to the fuel pump mounting stud.

##### b. *Component Replacement.*

(1) The igniter high tension cable is manufactured as part of the ignition transformer and is not serviceable separately. Refer to paragraph 4-27 for instructions on the replacement of the ignition transformer if the shielded high tension cable is defective.

(2) The motor ground strap is not serviceable. Report a defective ground strap to direct support maintenance.

#### 4-17. Testing of Radio Interference Suppression Components

a. *Suppression Resistor.* Test the suppression resistor with an ohmmeter. Resistance must be 4985 to 5050 ohms. Replace the resistor if it is damaged, or if its resistance is not within limits.

b. *Suppression Capacitors.* Refer testing of suppression capacitors to direct support maintenance.

## Section VII. MAINTENANCE OF HEATER CASE

#### 4-18. Description

The heater case contains and mounts the heater components. The rain shield (16, fig. 4-4) may be installed as shown in figure 4-4 to provide straight-through combustion air flow. The rain shield also may be inverted so that the air enters the combustion air inlet from the bottom, to prevent the entry of rain into the combustion air inlet. The warm air louver (10) snaps into place, and you can rotate it to any one of four positions to direct the flow of heated air up, down, or to either side. The top and side cover panels are interchangeable so that the ventilation air inlet screen can be positioned either on the top or side, as the heater location requires.

#### 4-19. Heater Case

##### a. *Removal and Disassembly.*

(1) Disconnect the power plug before removing the cover panels, unless you are going to perform operating tests or adjustments.

(2) Loosen four studs (3, fig. 4-4) that secure top cover panel (1) to heater case (21), remove it and set aside.

(3) Loosen four studs (6) that secure side cover panel (5) to heater case, remove and set aside.

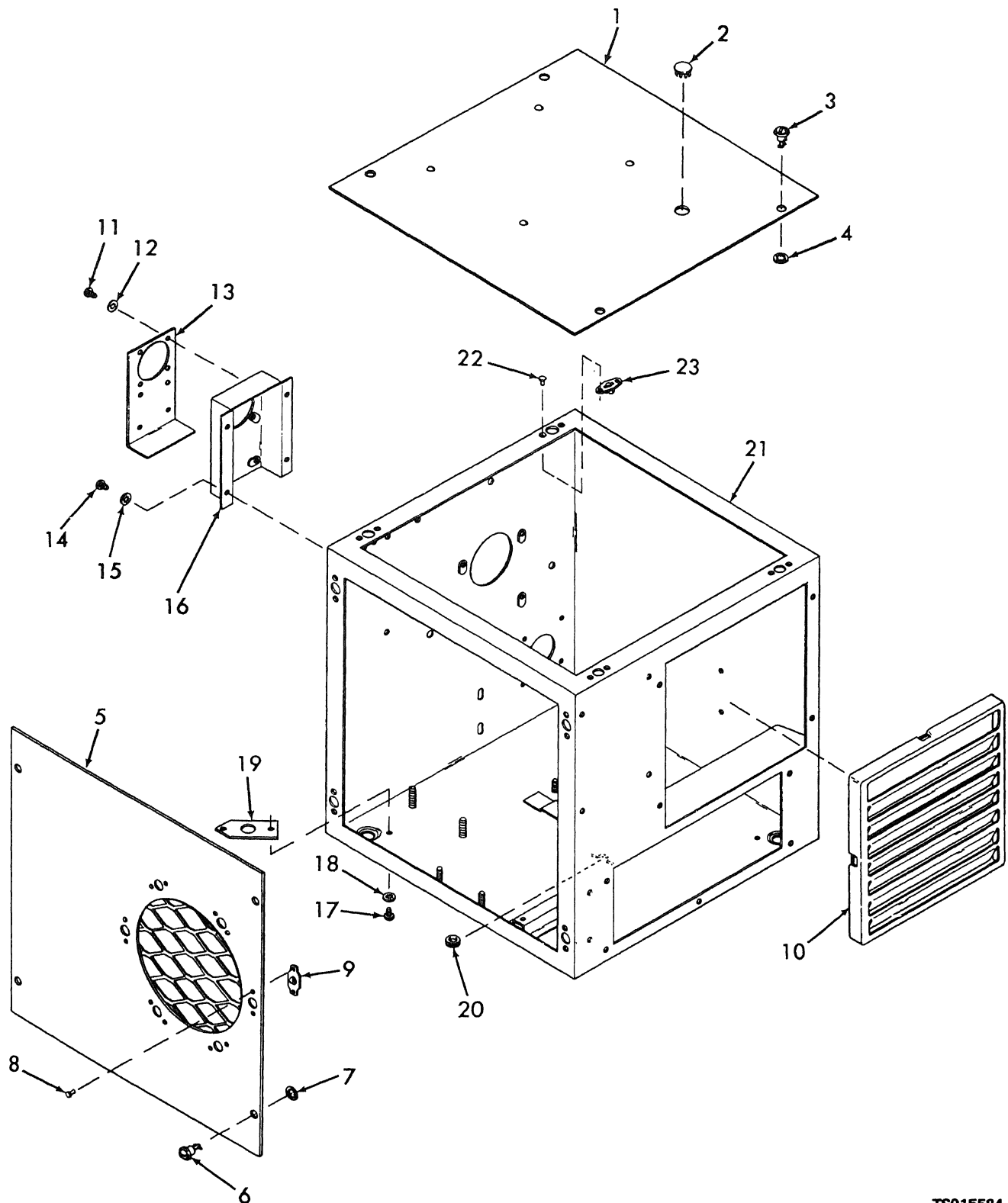
(4) Grasp the warm air louver (10) at the bottom portion of the louver, and pull up and outward, then set aside.

(5) To remove the receptacles (9 and 23), remove the rivets (8 and 22) with a cold chisel or drive them out using a 7/64-inch (2.77 mm) drill.

(6) Remove screws (11), lockwashers (12) and remove combustion air inlet (13) from rain shield (16).

(7) Remove screws (14), lockwashers (15) that secure rain shield (16) to heater case (21), and set aside.

(8) Remove screws (17), lockwashers (18) that secure nut plate (19) to heater case (21), and set aside.



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- |                    |                     |                     |                          |                 |                 |
|--------------------|---------------------|---------------------|--------------------------|-----------------|-----------------|
| 1. Top cover panel | 5. Side cover panel | 9. Receptacle       | 13. Combustion air inlet | 17. Screw       | 21. Heater case |
| 2. Plug            | 6. Stud             | 10. Warm air louver | 14. Screw                | 18. Lock washer | 22. Rivet       |
| 3. Stud            | 7. Washer           | 11. Screw           | 15. Lock washer          | 19. Nut plate   | 23. Receptacle  |
| 4. Washer          | 8. Rivet            | 12. Lock washer     | 16. Rain shield          | 20. Grommet     |                 |

Figure 4-4. Heater case, access panels, and covers, exploded view.

*b. Cleaning and Inspection.*

**WARNING**

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (fed. spec. P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100 to 138 F (38 to 59 C).

(1) Using a dry cloth, wipe dust and lint from the top and side cover panels, warm air louver, and combustion air inlet. Remove greasy or gummy deposits with a cloth dampened with dry cleaning solvent (fed. spec. P-D-680).

(2) Check the inside of the heater case for accumulations of dust and lint. If vacuum cleaning equipment is available, use it to clean the inside of the heater case, taking care not to disturb the wiring or damage components. If vacuum cleaning equipment is not available, use a clean, dry cloth to remove accumulations of dust and lint.

(3) Before reinstalling covers and warm air

louver, inspect heater components for fuel leaks, signs of burning or overheating, or other damage or malfunction. Refer to the appropriate repair sections of this publication for repair and replacement procedures.

*c. Reassembly.*

(1) Position nut plate (19, fig. 4-4) to heater case (21) and secure with lockwashers (18), screws (17).

(2) Position rain shield (16) to heater case, and secure with lockwashers (15), screws (14).

(3) Position combustion air inlet (13) to rain shield (16) and secure with lockwashers (12), screws (11).

(4) Position receptacle (23) to heater case and secure, using new rivets (22).

(5) Position receptacle (9) to side panel (5) and secure, using new rivets (8).

(6) Grasp the warm air louver (10), and position it at the top portion of the heater case opening, then swing it downward until it snaps into place.

(7) Position the side panel (5) to the heater case (21) and secure with four studs (6).

(8) Position the top cover panel (1) to the heater case (21), and secure with four studs (3).

## Section VIII. MAINTENANCE OF FUEL SYSTEM

### 4-20. Description

The space heater fuel system consists of a fuel filter, a fuel pump, a carburetor, and the interconnecting lines and fittings.

*a. Fuel Filter.* The fuel filter traps and holds dirt, moisture, and other contaminants before they enter the heater fuel tubes. The fuel filter has a replaceable element contained in a removable sediment bowl.

*b. Fuel Pump.* A 24-volt, pulsating-type electric fuel pump draws fuel from the fuel supply and pumps it to the carburetor. The pump also contains a filter to remove any contaminants which may have passed through the fuel filter.

*c. Carburetor.* The carburetor meters the flow of fuel to the burner head to achieve efficient combustion. Sensitive adjustment of this flow is provided by a fuel adjustment needle which enables you to manually adjust the flow rate according to the burning characteristics of the various fuels this heater will burn.

*d. Fuel Tubes.* Flexible fuel tubes carry the fuel

from the fuel filter to the fuel pump, and from the fuel pump to the carburetor. An overflow tube from the top of the carburetor fuel bowl to the burner head vents excess fuel to the burner head in the event of carburetor malfunction.

### 4-21. Fuel Filter, Fuel Tubes, and Fittings

*a. Fuel Filter Service.*

**WARNING**

The space heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before servicing or repairing the heater.

(1) Disconnect the power plug and shut off the fuel supply. Remove the top and side cover panels (para 4-19) to provide access to the fuel filter.

(2) Loosen the nut on the fuel filter bail. Swing the bail aside and remove the fuel bowl (1, fig. 4-5), gasket (2), and filter element (3) from the fuel filter body (4).

**WARNING**

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (fed. spec. P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100 to 138 F (38 to 59 C).

(3) Clean the parts with dry cleaning solvent (fed. spec. P-D-680) and allow all parts to dry thoroughly before reassembly. Replace the fuel filter element if it cannot be cleaned with cleaning solvent, or if it is cracked or damaged.

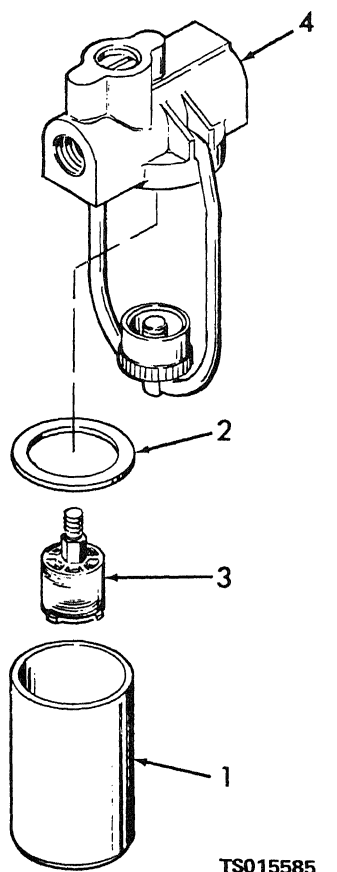
(4) Install the fuel filter element (3) in the filter body (4). Install the bowl (1), using a new gasket (2), and swing the bail in place. Engage the screw in the notch in the bottom of the bowl and tighten the nut hand tight.

(5) Turn on the fuel supply and connect the power plug. With the cover panels still removed, start the heater and check for leaks around the fuel filter bowl. If any leakage is detected, shut off the heater, disconnect the power plug, and correct the leak. Recheck heater operation and, when it is satisfactory, reinstall the cover panels (para 4-19).

*b. Removal.*

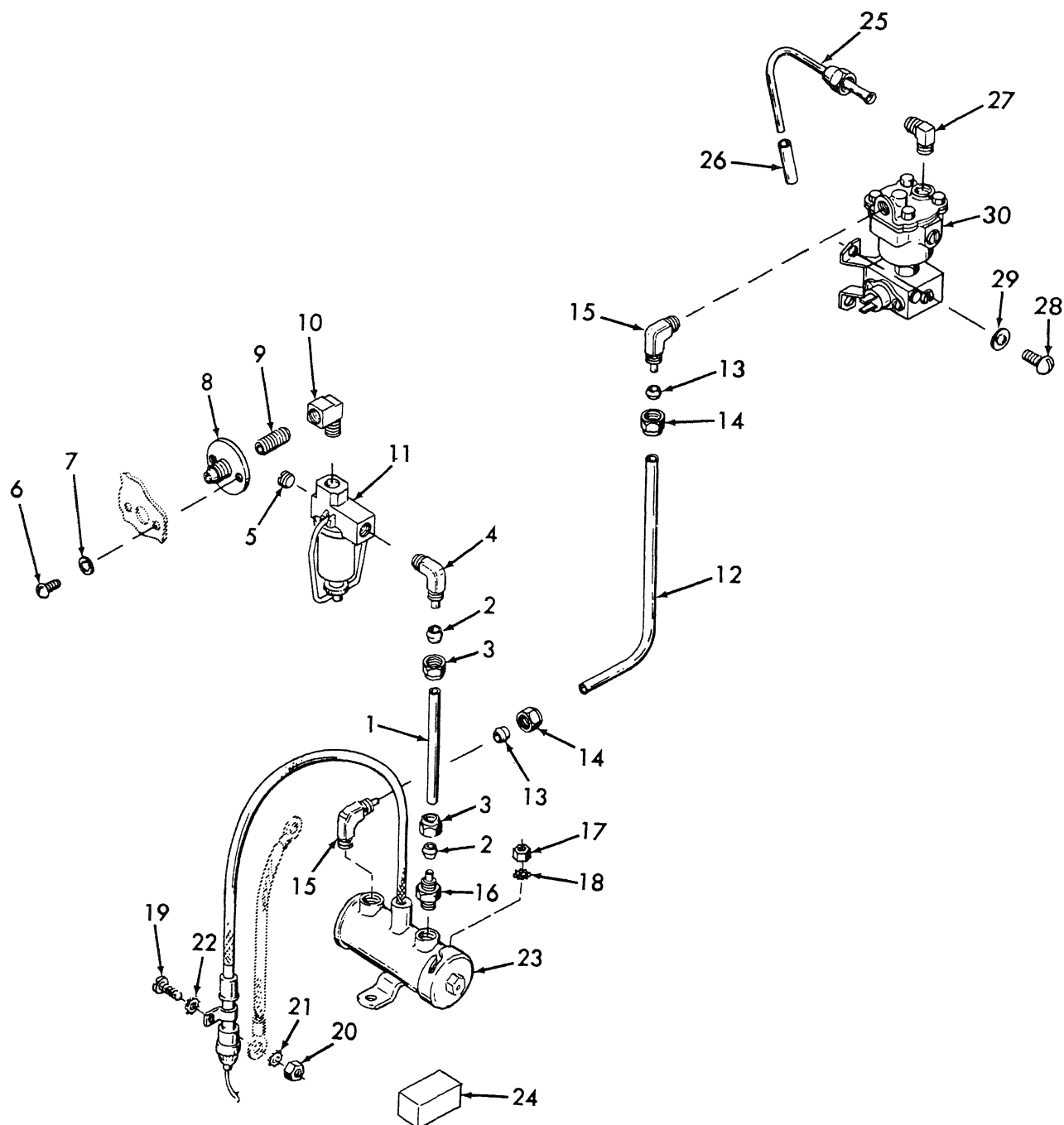
(1) Disconnect the power plug. Shut off the fuel supply and disconnect the fuel supply line at the bulkhead fitting. Remove the top and side cover panels (para 4-19) for access to the fuel filter, fuel tubes, and fittings.

(2) Disconnect the assembled fuel tube (1 thru 3, fig. 4-6), from the elbow (4) at the fuel filter outlet and the fuel pump inlet.



- |           |                     |
|-----------|---------------------|
| 1. Bowl   | 3. Filter element   |
| 2. Gasket | 4. Fuel filter body |

Figure 4-5. Fuel filter, exploded view.



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- |                       |                     |                        |                 |                   |
|-----------------------|---------------------|------------------------|-----------------|-------------------|
| 1. Fuel tube          | 7. Lock washer      | 13. Compression sleeve | 19. Screw       | 25. Overflow tube |
| 2. Compression sleeve | 8. Bulkhead fitting | 14. Compression nut    | 20. Nut         | 26. Tube          |
| 3. Compression nut    | 9. Close nipple     | 15. Elbow              | 21. Lock washer | 27. Elbow         |
| 4. Elbow              | 10. Elbow           | 16. Connector          | 22. Lock washer | 28. Screw         |
| 5. Plug               | 11. Fuel filter     | 17. Nut                | 23. Fuel pump   | 29. Lock washer   |
| 6. Screw              | 12. Fuel tube       | 18. Lock washer        | 24. Pad         | 30. Carburetor    |

Figure 4-6. Fuel system, exploded view.

(3) Remove the elbow (4) from the fuel filter (11). Remove the two screws (6) and lock washers (7) securing the bulkhead fitting (8) to the heater case. Disassemble the bulkhead fitting, close nipple (9), and elbow (10), and remove them from the fuel filter (11).

(4) Disconnect the assembled fuel tube (12 thru 14) from the fuel pump outlet and the carburetor inlet. Remove the elbows (15) and the connector (16).

*c. Cleaning and Inspection.*

**WARNING**

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (fed. spec. P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100 to 138 F (38 to 59 C).

(1) Clean metal parts in dry cleaning solvent (fed. spec. P-D-680) and allow all parts to dry thoroughly before reassembly.

(2) Clean the fuel filter element as described in subparagraph *a*, above.

(3) Inspect the fuel tubes for cracks, worn spots, restrictions, and other damage. Replace damaged tubes. The compression sleeves (2 and 13, fig. 4-6) and compression nuts (3 and 14) must be replaced when the fuel tubes are replaced.

(4) Replace any fittings that are cracked or have damaged threads.

*d. Installation.*

(1) Install the fuel tubes, fittings, and fuel filter in the reverse order of the index numbers in figure 4-6.

(2) Use Permatex No. 1, or equivalent, to coat the male NPT threads of the elbows (4, 10, and 15), plug (5), close nipple (9), and connector (16) before installing them. Do not apply any sealing compound to the threads of the compression fittings.

(3) Connect the fuel supply line to the bulkhead fitting and reconnect the power plug. Start the heater with the cover panels still removed and check for leaks. If any leakage is detected, shut off the heater, disconnect the power plug, and correct the leak. Recheck heater operation and, when satisfactory, reinstall the cover panels.

## 4-22. Fuel Pump

### *a. Fuel Pump Filter Service.*

**NOTE**

You can service the fuel pump filter without removing the fuel pump from the heater case.

**WARNING**

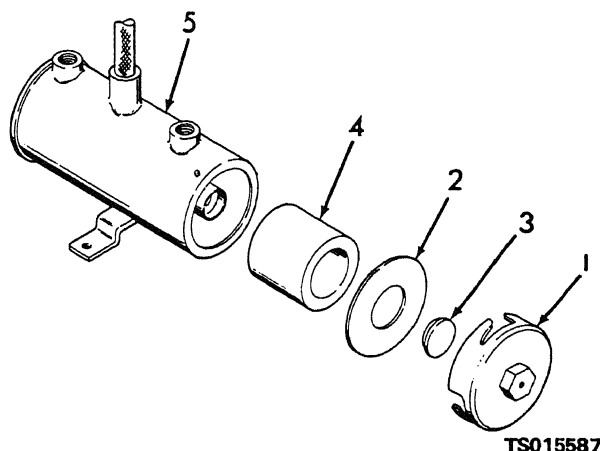
The space heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before repairing the heater.

(1) Disconnect the power plug and shut off the fuel supply. Remove the top and side cover panels (para 4-19) for access to the fuel pump filter.

**CAUTION**

Use a rag or a container to catch fuel that will leak from pump when cover is removed.

(2) Remove the end cover (1, fig. 4-7) by fitting a wrench on the hex end of the cover and turning it counterclockwise. Remove the cover, gasket (2), magnet (3), and filter element (4) from fuel pump (5).



- |              |                   |
|--------------|-------------------|
| 1. End cover | 4. Filter element |
| 2. Gasket    | 5. Fuel pump      |
| 3. Magnet    |                   |

Figure 4-7. Fuel pump filter, exploded view.

**WARNING**

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (fed. spec. P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100 to 138 F (38 to 59 C).

(3) Clean the parts with dry cleaning solvent (fed. spec. P-D-680) and allow all parts to dry thoroughly before reassembly. Replace the fuel pump filter element if it cannot be cleaned with cleaning solvent, or if it is cracked or damaged. Wipe the magnet to remove any metal chips which adhere to it.

(4) Install the filter element (4, fig. 4-7) in the fuel pump (5). Install the assembled cover (1), gasket (2), and magnet (3). To install the cover, use a wrench on the hex end and give the cover a quarter turn clockwise.

(5) Open the fuel supply valve and connect the power plug. With the cover panels still removed, start the heater and check for leaks around the fuel pump filter cover. If any leakage is detected, shut off the heater, disconnect the

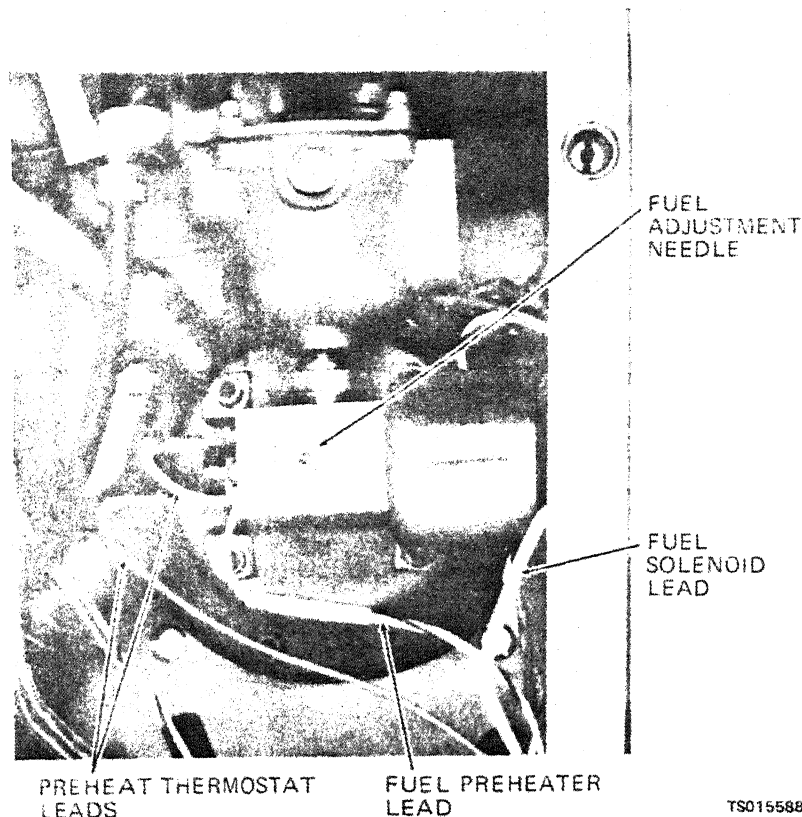
power plug, and correct the leak. Retest heater operation and, when it is satisfactory, reinstall the cover panels (para 4-19).

#### 4-23. Carburetor

*a. Fuel Adjustment.* When changing the type of fuel being burned in the heater, it will normally be necessary to readjust the fuel adjustment needle on the carburetor for proper combustion. Refer to figure 4-8 and adjust as follows:

##### NOTE

You can adjust the fuel adjustment needle without removing the side cover panel. Depending on which cover is installed on the side of the heater, you can make the adjustment through the ventilation air inlet screen or through the access hole after removing the plug (2, fig. 4-4).



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Figure 4-8. Carburetor fuel adjustment.

(1) If heater smokes, turn the fuel adjustment needle 1/8 turn clockwise to reduce the fuel flow. Observe heater operation for 1 minute. If smoking persists, turn the needle an additional 1/8 turn and observe operation. Continue until operation is satisfactory.

(2) If heater operation is erratic, turn the fuel adjustment needle 1/8 turn counterclockwise to increase fuel flow. Observe operation for 1 minute. Continue to turn the needle counterclockwise 1/8 turn at a time until heater operation is satisfactory. When heater is burning



smoothly, there should be little or no smoke from the exhaust outlet.

*b. Removal and Disassembly.*

**WARNING**

The space heater contains dangerous voltages which can cause severe electrical shock. Be sure to disconnect the power plug before repairing the heater.

(1) Disconnect the power plug and shut off the fuel supply. Remove the top and side cover panels (para 4-19) for access to the carburetor.

(2) Tag and disconnect the fuel preheater and preheat thermostat leads (fig. 4-8) and the fuel solenoid lead.

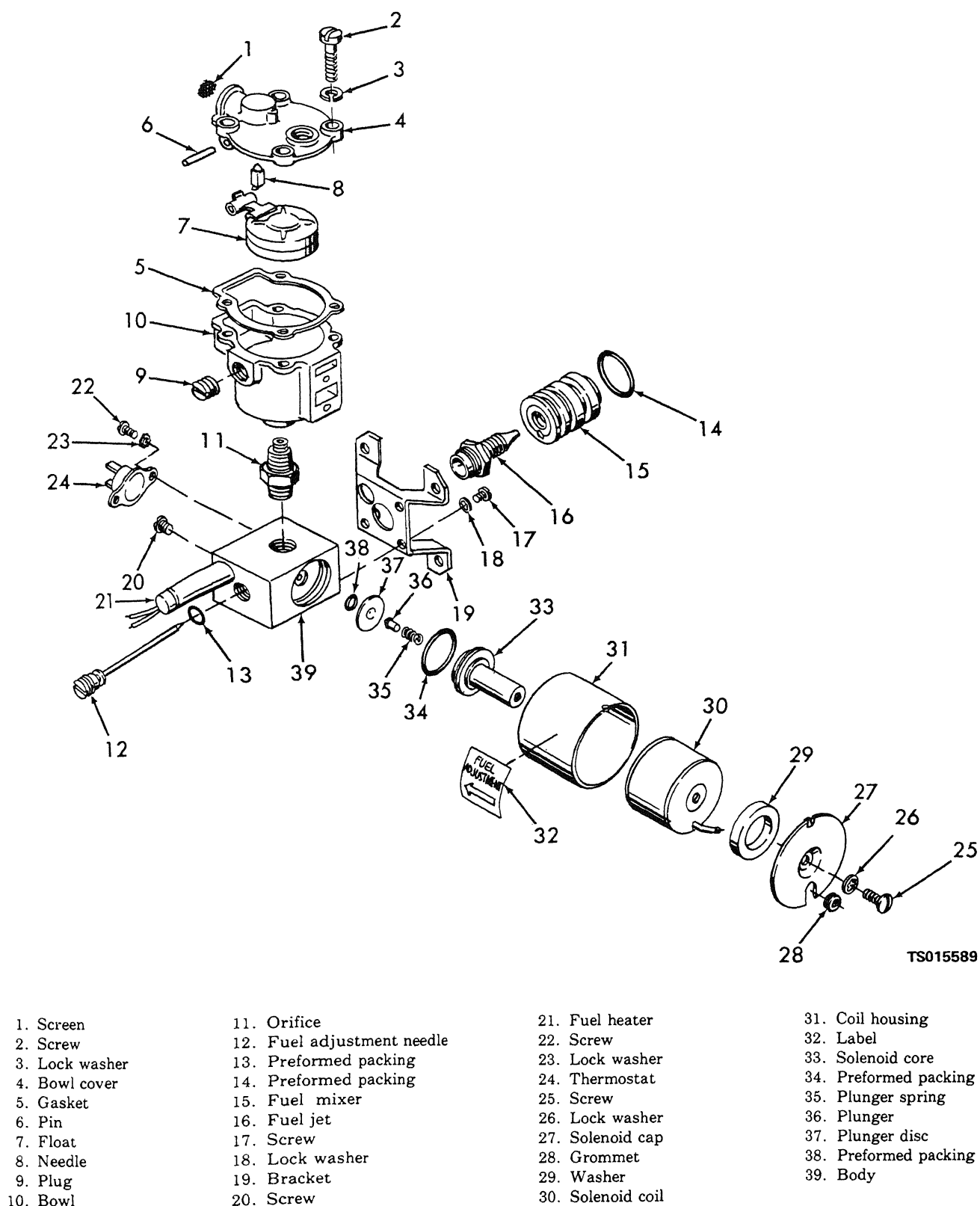
(3) Disconnect the compression nut (14, fig. 4-6) of the fuel tube (12) at the elbow (15) in the carburetor fuel inlet, and remove the elbow. Disconnect the overflow tube (25) from the elbow (27) on the top of the carburetor. Remove the overflow tube and the tube (26).

(4) Remove the four screws (28) and lock washers (29) securing the carburetor (30) to the burner head, and remove the carburetor.

(5) Unscrew the fuel adjustment needle (12, fig. 4-9) and remove the preformed packing (13) from the groove in the needle. Remove the two screws (22) and lock washers (23) securing the preheat thermostat (24) to the carburetor body (39) and remove the thermostat.

(6) Remove the screw (20) and pull the fuel heater (21) from the carburetor.

(7) Remove the screw (25) and lock washer (26) securing the solenoid cap (27) to the carburetor. Push the grommet (28) from the slot in the cap to free the solenoid lead. Remove the solenoid cap and the washer (29), and remove the solenoid coil (30) and coil housing (31) from the carburetor. Remove the preformed packing (14) from the fuel mixer (15) of the carburetor.



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Figure 4-9. Carburetor, exploded view.

### c. Cleaning and Inspection.

#### **WARNING**

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (fed. spec. P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100 to 138 F (38 to 59 C).

(1) Clean metal parts in dry cleaning solvent (fed. spec. P-D-680) and allow parts to dry thoroughly before reassembly. Do not immerse the thermostat, solenoid coil, or carburetor in solvent.

(2) Inspect the fuel adjustment needle tip for wear, scoring, or other damage. Replace the fuel adjustment needle if the needle is bent or damaged.

(3) Test the preheat thermostat for continuity. The thermostat contacts must be open (no continuity) at temperature of  $55 \pm 6$  F ( $12.78 \pm 3.33$  C). The contacts must be closed (continuity) at a temperature of  $40 \pm 6$  F ( $4.44 \pm 3.33$  C). Replace the thermostat if it does not perform as described.

(4) Test the fuel heater for proper operation. Connect the two heater leads to a source of 120-volt power. Replace the heater if it does not heat.

(5) Test the solenoid coil for continuity between the insulated lead and the braided ground lead. Replace the coil if it is open, if the coil insulation is damaged, or if the coil shows signs of overheating, fuel saturation, or other damage.

(6) Discard and replace the preformed packings and the grommet. The solenoid cap washer may be reused if it is not damaged, deformed or fuel-soaked.

### d. Reassembly and Installation.

(1) Install a new grommet (28, fig. 4-9) over the insulated solenoid coil lead, and slide the grommet into the slot in the solenoid cap (27).

(2) Install the coil housing (31) and solenoid coil (30) on the solenoid core (33). Be sure the braided solenoid lead is centered over the tapped

hole in the core. Install the washer (29) and solenoid cap (27), and secure with screw (25) and lockwasher (26).

(3) Install the fuel heater (21) in the carburetor body (39), with the leads toward the burner end of the carburetor. Install the retaining screw (20) and tighten just until snug. Do not force.

(4) Install the preheat thermostat (24) on the carburetor body and secure with two screws (22) and lock washers (23).

(5) Install a new preformed packing (13) in the groove on the fuel adjustment needle (12). Apply a few small drops of cyanoacrylate monomer type adhesive to the side of the groove toward the point of the needle and press the preformed packing into the adhesive. After the adhesive sets, coat the preformed packing and the needle groove with Grease, Aircraft, Fuel and Oil Resistant, per MIL-G-27617 or equivalent, and install the assembled needle and preformed packing in the carburetor. Tighten the adjustment needle gently until it just bottoms in the carburetor, then back it out two full turns to provide a preliminary fuel adjustment.

(6) Clean the fuel mixer groove that retains the preformed packing (14) on the carburetor. Install the preformed packing in the groove, and coat the packing with Grease, Aircraft, Fuel and Oil Resistant, per MIL-G-27617.

(7) Install the assembled carburetor in the burner head and secure with the four screws (28, fig. 4-6) and lock washers (29).

(8) Coat the male NPT threads of the elbow (27, fig. 4-6) with Permatex No. 1, or equivalent, and install the elbow in the top of the carburetor. Slide the tube (26) over the straight end of the overflow tube (25) and install on the burner head. Connect the other end of the overflow tube to the elbow (27).

(9) Coat the male NPT threads of the elbow (15) with Permatex No. 1, or equivalent, and install in the carburetor fuel inlet. Connect the fuel tube (12) to the elbow.

(10) Install the top and side cover panels (para 4-19). Connect the fuel supply and power plug, start the heater, and check operation. Adjust the fuel adjustment needle as described in subparagraph a, above.

## Section IX. MAINTENANCE OF ELECTRICAL SYSTEM

### 4-24. Description

a. *ON-OFF Switch.* The ON-OFF switch is

mounted on the control panel, and it enables you to start and stop the heater. After you turn the

switch to OFF, the blower motor will continue to run in a purge cycle to cool down the heater and remove unburned gases from the burner head.

*b. Fuseholders.* One fuseholder is mounted on the control panel and contains the main power fuse, which protects the heater from damage by breaking the heater power circuit if the current draw exceeds 7 amperes. A spare fuse is contained in the second fuseholder.

*c. Receptacles.* The power and thermostat receptacles provide quick connection and disconnection of the heater to the power source and to the room thermostat. Cover the receptacles with the removable dust caps when not in use.

*d. Ignition Transformer.* The ignition transformer steps up the 120-volt heater power to 5,000 volts to produce a spark at the igniter to ignite the fuel. A shielded high tension igniter cable connects the transformer output to the igniter.

*e. Thermocouple and Thermocouple Relay.* Once the burner is lighted, heat from the burning fuel heats the end of the thermocouple which projects into the heat exchanger. This heat generates a small current in the thermocouple. The other end of the thermocouple is connected to the thermocouple relay, and this small current which is generated energizes the relay coil, closing the relay contacts.

*f. Fuel Pump Power Supply.* The fuel pump power supply steps down the 120-volt heater power to 24 volts, and rectifies it from ac to dc to run the fuel pump power supply and to energize the fuel solenoid coil.

*g. Overheat Thermostat.* The overheat thermostat is mounted near the heat exchanger in the path of the air blown by the ventilation air blower. The thermostat contacts are normally closed, but if the temperature of the air flowing past the thermostat is above the thermostat cutout temperature (approximately 260 F) (126.67 C), the thermostat contacts open, stopping fuel flow to the burner head.

*h. Room Thermostat.* The room thermostat mounts on a wall in the heated enclosure. It is connected to the heater by a 3-wire cable which plugs into the front of the heater. The thermostat senses the temperature of the air in the enclosure and turns the heater on and off, as long as the ON-OFF switch is on and the heater is supplied with fuel.

*i. Fuel Heater and Fuel Preheat Thermostat.* The fuel heater is mounted in carburetor body. The fuel preheat thermostat contacts close below  $40 \pm 6$  F ( $4.44 \pm 3.33$  C), energizing the fuel heater whenever the ON-OFF switch is on. The heater

heats the carburetor and fuel bowl to ensure that the fuel will flow through the carburetor at any ambient temperature. The fuel preheat thermostat contacts open when the heater has raised the carburetor temperature above  $55 \pm 6$  F ( $12.78 \pm 3.33$  C).

*j. Blower Motor.* The blower motor provides both combustion air to support the burning of fuel in the burner head, and ventilation air to heat the enclosure. You can replace the motor brushes without removing the motor from the heater case. The blower motor has a thermal overload protector which shuts off the motor when it overheats.

#### 4-25. Description of Electrical System Operation

##### *a. Startup.*

(1) When the operator turns the ON-OFF switch S1 (fig. 1-3) to ON, and if the room thermostat contacts are closed, current flows through control relay K2 to the glow plug G1 to heat the combustion chamber, and to timer heater S7 to begin the time delay cycle.

(2) With S1 closed, power is also available at fuel preheat thermostat S6 to heat the carburetor body if the ambient temperature is below 40 F (4.44 C).

##### *b. Transition.*

(1) The time delay switch S8 is open at room temperature. Heat from timer heater S7 causes switch S8 to close after a delay of 30 to 35 seconds, at room temperature to as long as 2.5 minutes at  $-50$  F ( $-45.6$  C).

(2) When the time delay switch closes, it sends current to ignition transformer T1 to start the spark in the igniter, and to the fuel pump power supply (consisting of F2, T2, and CR1) to start the fuel pump L2. The power supply also energizes fuel pump solenoid L1 which opens a valve to start the flow of fuel into the burner head.

(3) The time delay switch S8 energizes the blower motor B1 through the control relay jumper wire to start the flow of combustion air into the burner head.

(4) The glow plug G1 and the timer heater S7 remain energized.

(5) The combination of heat from the glow plug and spark from the igniter make possible fuel ignition.

##### *c. Run (Burner Lighted).*

(1) If ignition proceeds normally in the transition stage, the heater lights, and heat from the burner is detected by the thermocouple which actuates thermocouple relay TC1 to close flame switch S3.

(2) When flame switch S3 closes, it energizes control relay K2. When control relay K2 is energized, it disconnects time delay heater S7 and bypasses the time delay switch S8.

(3) When energized, the control relay also sends power to the ignition transformer, fuel pump power supply, and blower motor. With the time delay circuit disconnected, the glow plug and timer heater shut off and cool, but the flame in the burner is sustained as long as fuel is supplied.

*d. Ignition Failure.*

(1) If the burner fails to light for any reason, the thermocouple and relay TC1 will not close flame switch S3. Control relay K2 will not energize to operate it in the run stage described in subparagraph c, above.

(2) In this situation, the glow plug and timer heater will temporarily remain energized. After a total of 30 to 35 seconds, heat from the timer heater will trip RESET switch S2 to shut off all power to the heater and to prevent damage to the glow plug or to the time delay mechanism.

(3) If the heater runs out of fuel, or if the fuel flow stops for any reason, the thermocouple and relay will also act to shut off the heater when the heat exchanger cools.

*e. Thermostatic Control.*

(1) When ON-OFF switch S1 is turned on, the thermostat will operate the heater automatically to control room temperature. When the room temperature reaches the thermostat setting, the thermostat contacts open, starting the shutdown stage of the heater cycle as described in subparagraph f, below.

(2) When the room temperature falls below the thermostat setting, the thermostat contacts close, causing the heater to enter the startup stage of its cycle.

(3) The thermostat will continue to turn the heater on and off to control room temperature as long as fuel and power are available to the heater.

*f. Shutdown.*

(1) When the operator turns ON-OFF switch S1 to OFF, or when the thermostat contacts open, the ignition and fuel pump power circuits are broken, stopping ignition and fuel flow.

(2) Power is still available to flame switch S3 to keep control relay K2 energized. Power is thus available to the relay to run blower B1 until all fuel in the burner is consumed. When the flame extinguishes, the blower circulates air to cool the heater.

(3) Air from the ventilation and combustion impellers cools the heat exchanger until thermocouple TC1 reaches its cutout setting. The thermocouple relay opens flame switch S3 to deenergize K2. This shuts off power to the blower and prepares the heater for the next startup.

*g. Overheat.*

(1) If the heater overheats because of reduced ventilation air flow, excessive fuel flow, or other causes, overheat thermostat S5 opens. This breaks the flow of current to the fuel pump and carburetor solenoid valve, shutting off the flow of fuel.

(2) Current still flows through K2 to operate the blower, cooling down the heat exchanger. When the heat exchanger temperature reaches a safe level, the overheat switch closes to restart fuel flow and ignition. Because the heat exchanger and burner head are still quite warm, ignition is rapid and glow plug and time delay assembly are not utilized.

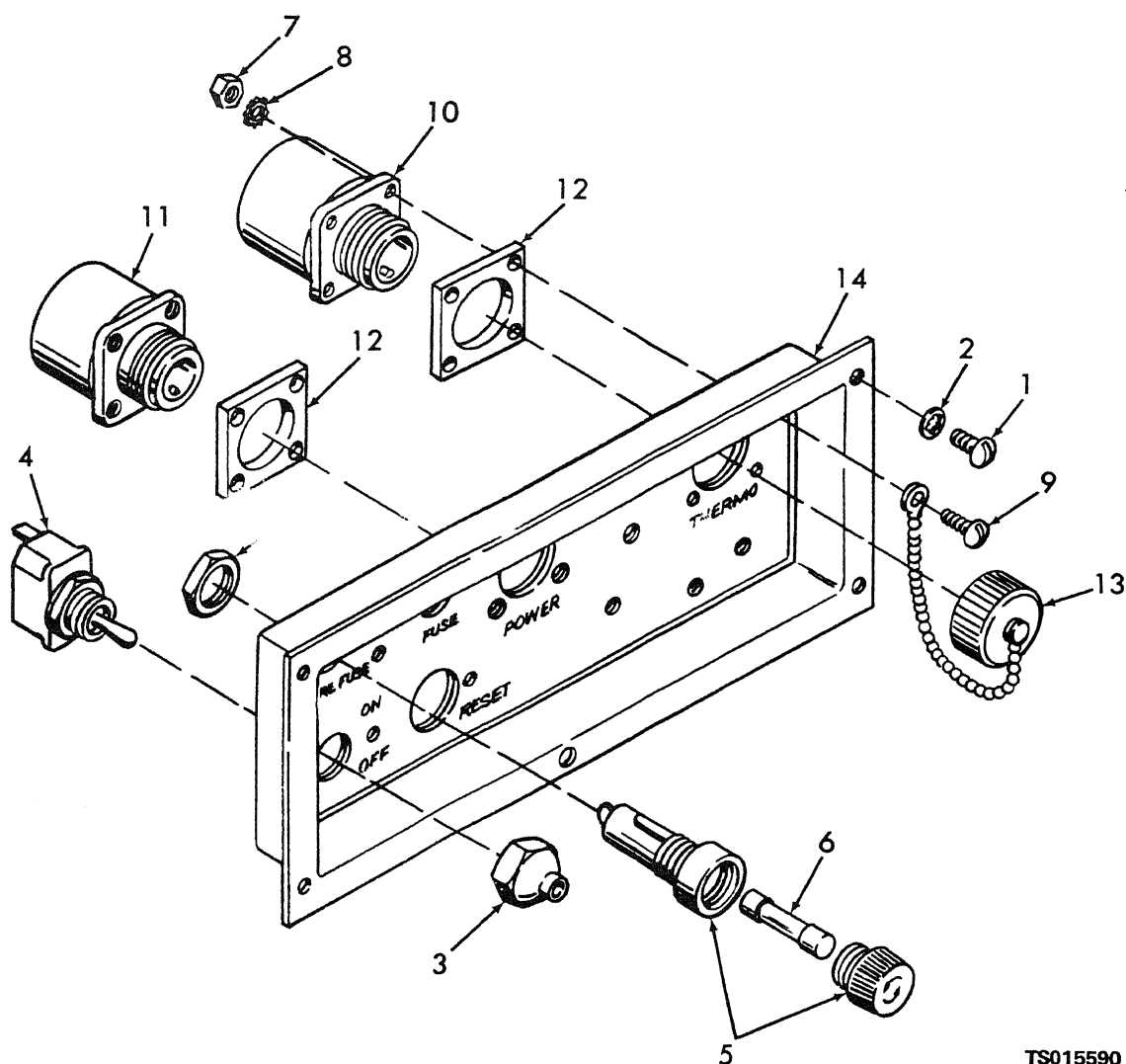
*h. Motor Overload.* A motor overload will trip the thermal overload protector to stop the motor. The motor will remain stopped until motor temperature reduces enough to allow the overload protector to reset. When the motor shuts off and combustion air to the burner is interrupted, the flame will extinguish, since no fuel aspiration will occur. The flame will normally reignite within a short time.

#### 4-26. Control Panel Fuse, Switch, and Receptacles

*a. Removal and Disassembly.*

(1) Disconnect the power plug and remove the top and side cover panels to provide access to the back of the control panel.

(2) Remove the five screws (1, fig. 4-10) and lock washers (2) securing the control panel to the heater case. Pull out gently on the control panel to provide access to the wiring on the back of the panel.



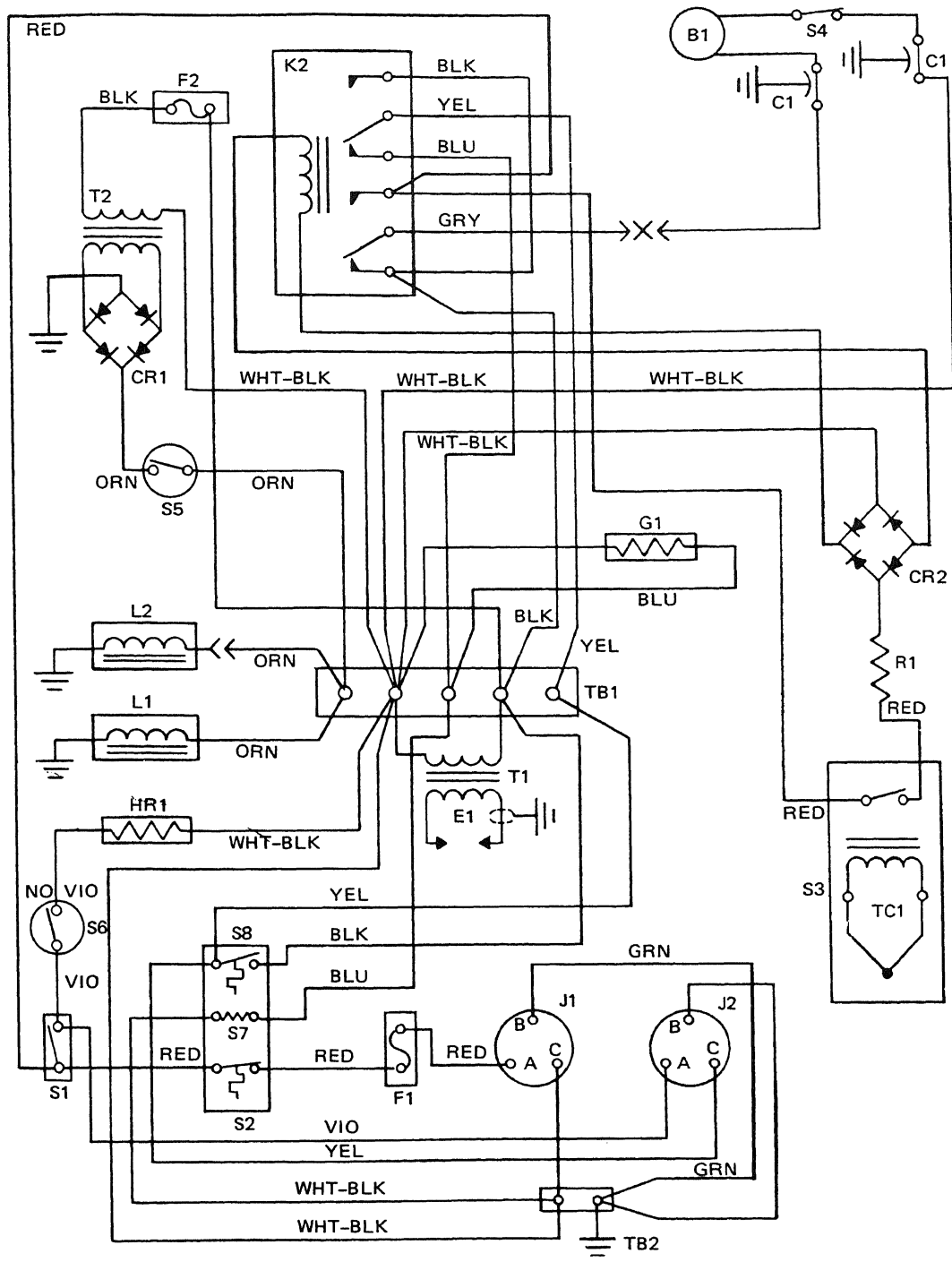
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- |                               |                       |
|-------------------------------|-----------------------|
| 1. Screw                      | 8. Lock washer        |
| 2. Lock washer                | 9. Screw              |
| 3. Boot                       | 10. THERMO receptacle |
| 4. ON-OFF switch              | 11. POWER receptacle  |
| 5. Fuseholder (including nut) | 12. Gasket            |
| 6. Fuse                       | 13. Dust cap          |
| 7. Nut                        | 14. Control panel     |

Figure 4-10. Control panel, exploded view.

(3) Tag and unsolder the two red and two violet leads from the ON-OFF switch. Refer to the wiring diagram (fig. 4-11). Unscrew the boot (3,

fig. 4-10) and remove the ON-OFF switch (4) from the back of the control panel.



KEY TO DIAGRAM					
ITEM	KEY	ITEM	KEY	ITEM	KEY
VENT & COMB MOTOR	B1	RECEPTACLE POWER	J1	MOTOR PROTECTOR	S4
CAPACITOR	C1	RECEPTACLE THERMO	J2	SW. OVERHEAT THERMO	S5
RECTIFIER BRIDGE	CR1	RELAY DPDT	K2	SW. FUEL THERMO	S6
	CR2	VALVE SOLENOID	L1	TIMER HEATER	S7
IGNITER	E1	FUEL PUMP NEG GRD	L2	SW. DELAY	S8
FUSE	F1	RESISTOR	R1	IGNITION XFMR	T1
FUSE	F2	SW. ON OFF SPST	S1	PUMP POWER XFMR	T2
GLOW PLUG	G1	HEATER RESET SW.	S2	TERMINAL	TB1
HEATER FUEL BLOCK	HR1	SW. FLAME	S3	TERMINAL	TB2
				THERMOCOUPLE	TC1

Figure 4-11. Wiring diagram.

(4) Push in the cap on the fuseholder (5) and rotate the cap counterclockwise to remove it from the fuseholder. Remove the fuse (6) from the fuseholder. Tag and unsolder the two red wires from the fuseholder. Remove the fuseholder nut and pull the fuseholder from the front of the control panel. Remove the spare fuseholder the same way.

(5) Remove the four nuts (7), lock washers (8), and screws (9) securing the THERMO receptacle (10) to the control panel. Remove the receptacle, gasket (12) and dust cap (13). Unsolder the wires from the pin contacts. Repeat this procedure for the POWER receptacle (11).

*b. Cleaning and Inspection.*

(1) Clean the switch, fuseholders, and receptacles with a clean, dry cloth or a soft-bristle brush.

(2) Do not repair the ON-OFF switch, fuseholders, or receptacles. Replace these parts if they are damaged or defective.

(3) Discard and replace the gaskets.

*c. Reassembly and Installation.*

(1) Use only rosin-core solder for all soldered

connections. Consult the wiring diagram (fig. 4-11) for correct wiring connections.

(2) Reinstall the assembled control panel in the heater case and secure with the five screws (1, fig. 4-10) and lock washers (2). Reinstall the top and side cover panels, connect the power plug, and check heater operation.

#### 4-27. Ignition Transformer

*a. Removal.*

(1) Disconnect the power plug and remove the top and side cover panels (para 4-19) to provide access to the ignition transformer. Unscrew the nut (23, fig. 4-12) on the end of the ignition high tension cable. Remove the suppression resistor (1) from the cable end.

(2) Disconnect the ignition transformer power leads from the terminal board. Remove the two screws (2) and lock washers (3) securing the clamp (4) to the bracket (8). Remove the clamp and ignition transformer (5) from the heater case. If the bracket is damaged, remove the two nuts (6) and lock washers (7) securing the bracket to the heater case. Lift the bracket up and pull it out to remove it from the heater case.



1. Suppression resistor
2. Screw
3. Lock washer
4. Clamp
5. Ignition transformer
6. Nut

7. Lock washer
8. Bracket
9. Compression nut
10. Compression sleeve
11. Thermocouple
12. Grommet

13. Thermocouple relay
14. Screw
15. Lock washer
16. Screw
17. Lock washer
18. Fuel pump power supply

19. Screw
20. Lock washer
21. Overheat thermostat
22. Grommet
23. Cable nut

b. Cleaning and Inspection.

**WARNING**  
Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (fed. spec. P-D-680) used to clean parts is potentially

(1) Clean metal parts with a cloth dampened lightly with dry cleaning solvent (fed. spec. P-D-680). Do not immerse the ignition transformer in solvent.

(2) Inspect the ignition transformer for signs of overheating. Inspect the high tension cable and its braided wire shield for wear and other damage. The high tension cable is not serviceable separately, so the complete transformer assembly must be replaced if the cable is damaged.

(3) Test the transformer for continuity. There must be continuity between the black and white-black transformer leads, and between the high tension cable and the transformer case. Replace the transformer if it is defective.

*c. Installation.*

(1) Install bracket (8, fig. 4-2) with lockwashers (7), nuts (6) to the heater case.

(2) Position ignition transformer (5) on bracket (8), and secure with clamp (4), located on top of ignition transformer, lockwashers (3), screws (2).

(3) Connect the ignition transformer power leads to the terminal board (see wiring diagram (fig. 4-11) for correct wiring connections).

(4) Tighten the cable nut (23) on the end of ignition high tension cable.

(5) Install the top and side cover panels. Connect the power plug and check the heater operation.

#### 4-28. Thermocouple and Thermocouple Relay

*a. Removal.*

(1) Disconnect the power plug and remove the top and side cover panels (para 4-19) and the warm air louver (fig. 4-4) to provide access to the thermocouple relay.

(2) Unscrew the compression nut (9, fig. 4-12) on the end of the thermocouple and pull up the thermocouple (11) to remove it from the heat exchanger. Press out the grommet (12) from the hole in the exchanger housing and pull the thermocouple free of the housing.

(3) Remove the screw on the top of the thermocouple relay (13). Disconnect and remove the thermocouple from the thermocouple relay.

(4) Remove the knurled screw on the front of the thermocouple relay cover and remove the cover. Disconnect the two red leads from terminals inside the thermocouple relay. Remove the four screws (14) and lockwashers (15) securing the thermocouple relay to the heater case; remove the thermocouple relay.

*b. Cleaning and Inspection.*

**WARNING**

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (fed. spec. P-D-680)

used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100 to 138 F (38 to 59 C).

(1) Clean metal parts with a cloth dampened with dry cleaning solvent (fed. spec. P-D-680). Do not immerse the thermocouple relay in solvent. Allow all parts to dry thoroughly before reinstalling them in the heater case.

(2) Remove combustion deposits from the sensor end of the thermocouple with a fine-grit stone or sandpaper. Replace the thermocouple if the lead is kinked or broken, or if the terminal or terminal insulation is distorted or otherwise damaged.

(3) The thermocouple and thermocouple relay may be tested by connecting the thermocouple to the relay and heating the thermocouple sensor with a cigarette lighter or small torch. There should be no continuity across the thermocouple relay terminals until the thermocouple sensor has been heated. No repair is possible to the thermocouple or thermocouple relay.

*c. Installation.*

(1) Install compression nut (9, fig. 4-12) on end of the thermocouple, and secure it to the heat exchanger.

(2) Position opposite end of thermocouple lead on top of thermocouple relay (13), and secure with nut.

(3) Install the warm air louver (fig. 4-4) and top and side cover panels (para 4-19). Connect the power plug and check heater for proper operation.

#### 4-29. Overheat Thermostat

*a. Removal.*

(1) Disconnect the power plug. Remove the top and side cover panels (para 4-19), and warm air louver (fig. 4-4) for access to the overheat thermostat and wiring.

(2) Disconnect the two orange leads from the overheat thermostat, and slide the leads out through the grommet (22, fig. 4-12).

(3) Remove the two screws (19) and lockwashers (20) securing the overheat thermostat (21) to the bracket in the exchanger housing. Remove the overheat thermostat.

*b. Inspection.*

(1) Inspect the overheat thermostat for damaged terminals, broken insulation, or other damage. Replace a damaged thermostat.

(2) There must be continuity across the overheat thermostat terminals at room temperature, and up to a temperature of  $250 \pm 6$  F

(121.11  $\pm$  3.33 C). Replace the thermostat if it is open below this temperature range, or if it is still closed above 256 F (124.44 C). When cooling, the thermostat must reopen at 210°  $\pm$  12 F (98.89  $\pm$  6.67 C).

*c. Installation.*

(1) Install the thermostat in the bracket in the exchanger housing and secure with the two screws (19, fig. 4-12) and lock washers (20).

(2) Slide the two orange thermostat leads through the grommet (22) and install the grommet in the exchanger housing. Connect leads to the two thermostat terminals.

(3) Install the warm air louver (fig. 4-4) and install the top and side cover panels (para 4-19). Check the heater for proper operation.

#### 4-30. Fuel Pump Power Supply

*a. Removal.*

(1) Disconnect the power plug and remove the top and side cover panels (para 4-19), to provide access to the fuel pump power supply.

(2) Disconnect the black and white-black fuel pump power supply leads at the terminal board. Remove the warm air louver (fig. 4-4) and disconnect the orange fuel pump power supply lead at the overheat thermostat. Feed the lead through the grommet (22, fig. 4-12).

(3) Remove the two screws (16) and lock washers (17) securing the fuel pump power supply to the heater case, and remove the fuel pump power supply.

*b. Cleaning and Inspection.*

**WARNING**

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (fed. spec. P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100 to 138 F (38 to 59 C).

(1) Clean the fuel pump power supply case with a cloth dampened lightly with dry cleaning solvent (fed. spec. P-D-680). Take care to prevent saturation of electrical parts.

(2) Remove the fuel pump power supply fuse and test for continuity. Replace a defective fuse. Apply 115-volt, 50/60-hertz alternating current across the black and white-black power supply leads and check dc voltage output across the orange lead and ground. Output must be 24 volts. Replace a defective fuel pump power supply.

*c. Installation.*

(1) Install the fuel pump power supply in the

heater case and secure with the two screws (16, fig. 4-12) and lock washers (17). Refer to the wiring diagram (fig. 4-11) and connect the black, white-black, and orange power supply leads.

(2) Install the warm air louver (fig. 4-4) and the top and side cover panels (para 4-19). Connect the power plug and check the heater for proper operation.

**4-31. Fuel Preheat Thermostat and Fuel Heater Service and inspection procedures for the fuel preheat thermostat and fuel heater are included with the carburetor service instructions. Refer to paragraph 4-23.**

#### 4-32. Motor Brushes

*a. Removal.*

(1) Disconnect the power plug and remove the top and side cover panels.

(2) Refer to figure 4-13, and remove the motor brush caps. Remove the motor brushes from the brush holders.

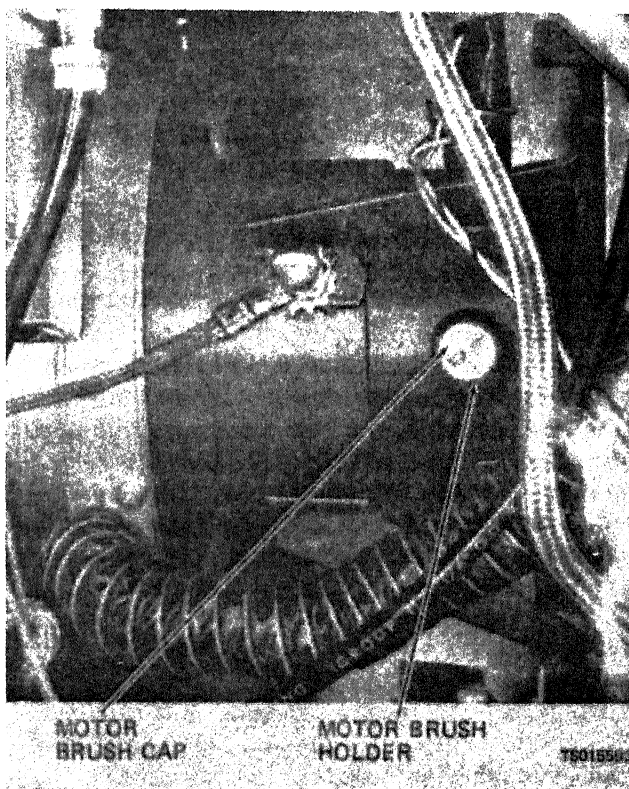


Figure 4-13. Motor brush installation.

*b. Inspection.*

(1) Inspect the wear faces of the brushes for signs of scoring, uneven wear, burning, pitting, or other damage. Scored or unevenly worn brushes indicate that the motor armature is defective. Report the condition to direct support maintenance.

(2) Replace the brushes if the brush lead is broken, or if the brushes are worn to less than 5/16 inch (7.9375 mm) long.

*c. Installation.*

(1) Align the curve of the brush wear face with the curvature of the motor armature commutator, and install the brushes in the brush holders. Reinstall the brush caps.

(2) Reinstall the top and side covers (para 4-19), and connect the power plug. Start the heater and check for proper operation.

#### 4-33. Room Thermostat

*a.* No repair is authorized for the room thermostat. Replace a defective thermostat, making sure you install it as described in paragraph 4-3.

*b.* The thermostat may be cleaned by removing the cover and wiping away accumulations of dust and lint with a soft-bristle brush. Check that all wiring connections are tight and reinstall the cover.

### Section X. MAINTENANCE OF BURNER HEAD

#### 4-34. Description

*a. Combustion Air Hose.* The combustion air hose is a springwound, neoprene-coated tube which conducts the combustion air from the combustion air blower outlet to the combustion air inlet on the burner head.

*b. Igniter.* The igniter is similar to an automotive spark plug, and it performs a similar function. High voltage from the ignition transformer creates a spark between the igniter electrode and a ground within the burner head. It is this spark which ignites the fuel and air mixture in the burner head.

*c. Glow Plug.* The glow plug is energized only while the heater is being started. The glow plug preheats the burner head to ensure vaporization of the fuel for rapid ignition.

*d. Burner Head.* The burner head provides mounting for the carburetor, igniter, and glow plug, and contains a small combustion chamber. Air from the combustion air blower enters the burner head through the combustion air hose, and mixes with the fuel metered by the carburetor. Spark from the igniter ignites the fuel and air

mixture inside the burner head. The burning gases pass through the heat exchanger, which heats ventilation air flowing around it, and exit the heater through the exhaust pipe.

#### 4-35. Igniter, Glow Plug, and Combustion Air Hose

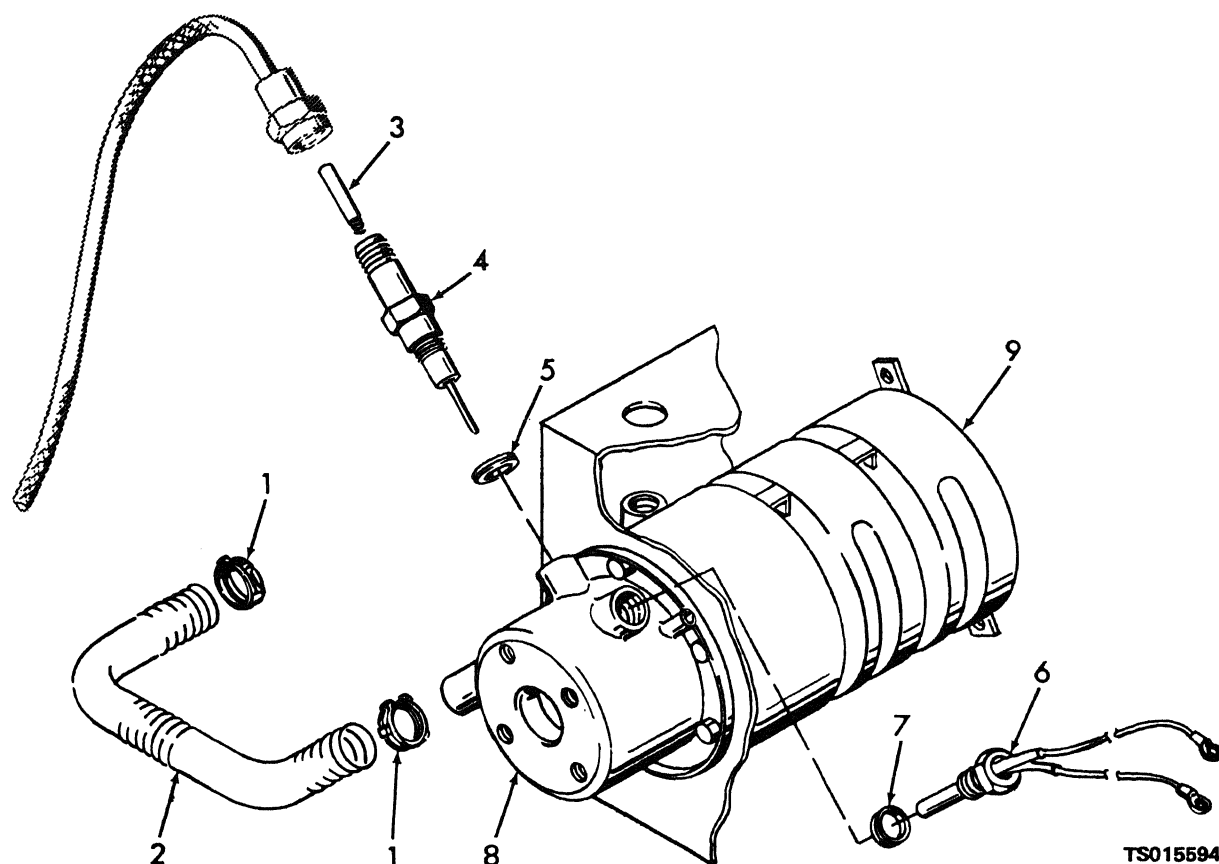
*a. Removal.*

(1) Disconnect the power plug and remove the top and side cover panels (para 4-19) to provide access to the burner head.

(2) Loosen the two clamps (1, fig. 4-14) securing the combustion air hose (2) to the combustion air blower outlet and the burner head. Remove the combustion air hose, and remove the clamps from the hose.

(3) Unscrew the nut on the ignition high tension cable and remove the high tension cable and the suppression resistor (3). Unscrew the igniter (4), and remove the igniter and the gasket (5) from the burner head.

(4) Disconnect the blue and white-black glow plug leads at the terminal board. Unscrew and remove the glow plug (6) and gasket (7) from the burner head (8).



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- |                         |              |                   |
|-------------------------|--------------|-------------------|
| 1. Clamp                | 4. Igniter   | 7. Gasket         |
| 2. Combustion air hose  | 5. Gasket    | 8. Burner head    |
| 3. Suppression resistor | 6. Glow plug | 9. Heat exchanger |

Figure 4-14. Burner head components (carburetor removed).

#### b. Cleaning and Inspection.

##### WARNING

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (fed. spec. P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100 to 138 F (38 to 59 C).

(1) Clean the igniter, the glow plug, and the outside of the burner head with dry cleaning solvent (fed. spec. P-D-680). Do not immerse the glow plug in solvent or allow solvent to enter the burner head. Allow all parts to dry thoroughly before installation.

(2) Inspect the igniter electrode and outer shell for burning or pitting. Inspect ceramic parts

for cracks or breaks. Inspect threads for damage. Replace a damaged igniter.

(3) Inspect the glow plug for cracks, frayed insulation, loose or broken leads, and other damage. Apply 120 vac across the glow plug leads and check that the glow plug heats. Replace a damaged or defective glow plug.

(4) Clean the combustion air hose by shaking it or blowing through it with compressed air. Replace the hose if it is torn, restricted, or damaged.

(5) Report a damaged or defective burner head to direct support maintenance for repair.

(6) Discard and replace the gaskets.

##### c. Installation.

(1) Install the glow plug (6, fig. 4) igniter (4) in the burner head (8), gaskets (5 and 7). Connect the glow plug to the terminal board, and connect the ignition tension cable.

(2) Slide the clamps (1) over the

combustion air hose (2), and fit the hose over the combustion air blower outlet and the burner head air inlet. Tighten the clamps.

(3) Reinstall the top and side cover panels (para 4-19), connect the power plug, and test the heater operation.

## CHAPTER 5

### DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

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#### Section I. REPAIR PARTS, SPECIAL TOOLS, AND EQUIPMENT

##### 5-1. Tools and Equipment

The equipment issued with the heater assembly is illustrated in figure 1-1.

##### 5-2. Special Tools and Equipment

No special tools or equipment is required for direct support or general support maintenance of the heater assembly.

##### 5-3. Maintenance Repair Parts

Repair parts and equipment are listed and illustrated in the repair parts and special tools list covering direct support and general support maintenance for this equipment. Refer to TM 5-4520-239-24P.

#### Section II. TROUBLESHOOTING

##### 5-4. General

a. This section contains troubleshooting information for locating and correcting most of the operating troubles which are the responsibility of direct support and general support maintenance. Each malfunction is followed by a list of tests or inspections which will help you to determine probable causes and corrective actions to take. Perform the tests/inspections and corrective actions in the order listed.

b. This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify your supervisor.

c. Only those functions which are solely within the scope of direct support and general support maintenance are listed. For troubleshooting procedures which are within the scope of operator/crew maintenance, refer to paragraph 3-

4. For troubleshooting procedures which are within the scope of organizational maintenance, refer to paragraph 4-12.

##### 5-5. Direct Support and General Support Maintenance Troubleshooting Chart

Refer to table 5-1 for troubleshooting which is allocated to direct support and general support maintenance levels.

##### WARNING

The space heater contains dangerous voltages which can cause severe electrical shock or death. Be extremely careful when making voltage measurements or other checks with the heater connected to the power source during troubleshooting. Always remove the power plug before making any continuity tests.

Table 5-1. Direct Support and General Support Troubleshooting

**MALFUNCTION****TEST OR INSPECTION****CORRECTIVE ACTION****1. HEATER FAILS TO START (NO FLAME, NO BLOWER).**

Step 1. Remove top and side cover panels, and pull out control panel. With power connected, turn heater on and check that the time delay assembly heats.

Replace the time delay assembly if it fails to become noticeably warm within 45 to 70 seconds. Refer to paragraphs 6-2 thru 6-4.

Step 2. With power on, briefly jump yellow and black leads on terminal board.

If blower begins to run, replace the time delay assembly (para 6-2 thru 6-4).

Step 3. Disconnect power plug and allow time delay assembly to cool. Press RESET button and check continuity between two red leads.

Replace the time delay assembly if the switch is open after reset (para 6-2 thru 6-4).

Step 4. Check control relay (para 6-2).

Replace a defective control relay (para 6-2 thru 6-4).

**2. HEATER IGNITES BUT BLOWER FAILS TO RUN.**

Step 1. Turn power on, wait for time delay, and check for 120 volts across motor terminals.

Replace control relay if there is no power at motor terminals. Refer to paragraphs 6-2 and 6-4.

Step 2. Disconnect motor leads at plug in connector and terminal board. Connect to external source of 120-volt, 50/60-hertz, single-phase, alternating current.

Replace motor if it fails to run.

**3. HEATER IGNITES BUT BLOWER SHUTS OFF AFTER A SHORT TIME.**

Step 1. Disconnect power plug and pull out control panel. Disconnect resistor leads and check resistor continuity.

Replace resistor if open or damaged (para 6-2 thru 6-4).

Step 2. Unsolder two red leads at terminal board lugs connected to rectifier CR2 leads from red and black (or unmarked) corners (fig. 4-11). Check resistance across red and black corners of rectifier.

If resistance is high with one test lead polarity and low with the other test lead polarity, rectifier is good and control relay must be replaced (para 6-2 thru 6-4). If resistance readings are the same or nearly the same with both test probe polarities, replace rectifier (para 6-2 thru 6-4).

**4. HEATER OVERHEATS.**

Step 1. Disconnect power plug and remove top and side cover panels (para 4-19). Check that the ventilation air impeller (17, fig. 9-1) is tight on the motor shaft, and not damaged.

Tighten the impeller, or replace it if defective (para 9-2 thru 9-4).

Step 2. Connect power plug, start heater, and observe blower operation with cover panels removed.

Replace blower motor if motor runs slowly or vibrates due to defective bearings, or if the motor protector switch S4 (fig. 4-11) trips out. Refer to paragraphs 9-2 thru 9-4.



## CHAPTER 6

## REPAIR OF ELECTRICAL CONTROL COMPONENTS

## 6-1. Description

The following electrical control components help control heater operation:

*a. Time Delay Assembly.* The time delay assembly (6, fig. 6-1) consists of the timer heater S7 (fig. 1-3), RESET switch S2, and the time delay switch S8.

(1) The timer heater is energized when the ON-OFF switch is turned on, and it heats both the time delay switch and the RESET switch.

(2) The time delay switch S8 is normally open, until heat from the timer heater closes it. The time required for the timer heater to heat the time delay switch to its closing point is longer than the time required by the glow plug to preheat the burner head to ensure rapid fuel ignition.

(3) When the time delay switch finally closes from the heat of S7, it energizes the ignition transformer T1 and the fuel pump power supply, starting ignition and fuel flow to the burner head.

(4) If ignition proceeds normally, the thermocouple relay closes the flame switch S3 to energize the control relay. This disconnects the timer heater, allowing it to cool down, and bypasses the time delay switch.

(5) The RESET switch is normally closed. If the burner does not ignite, the timer heater will continue to heat the RESET switch to its opening point. When the RESET switch opens, it shuts off all power to the heater. The RESET switch requires manual reset.

*b. Rectifier.* Rectifier CR2 changes the heater power from ac to dc to energize control relay K2.

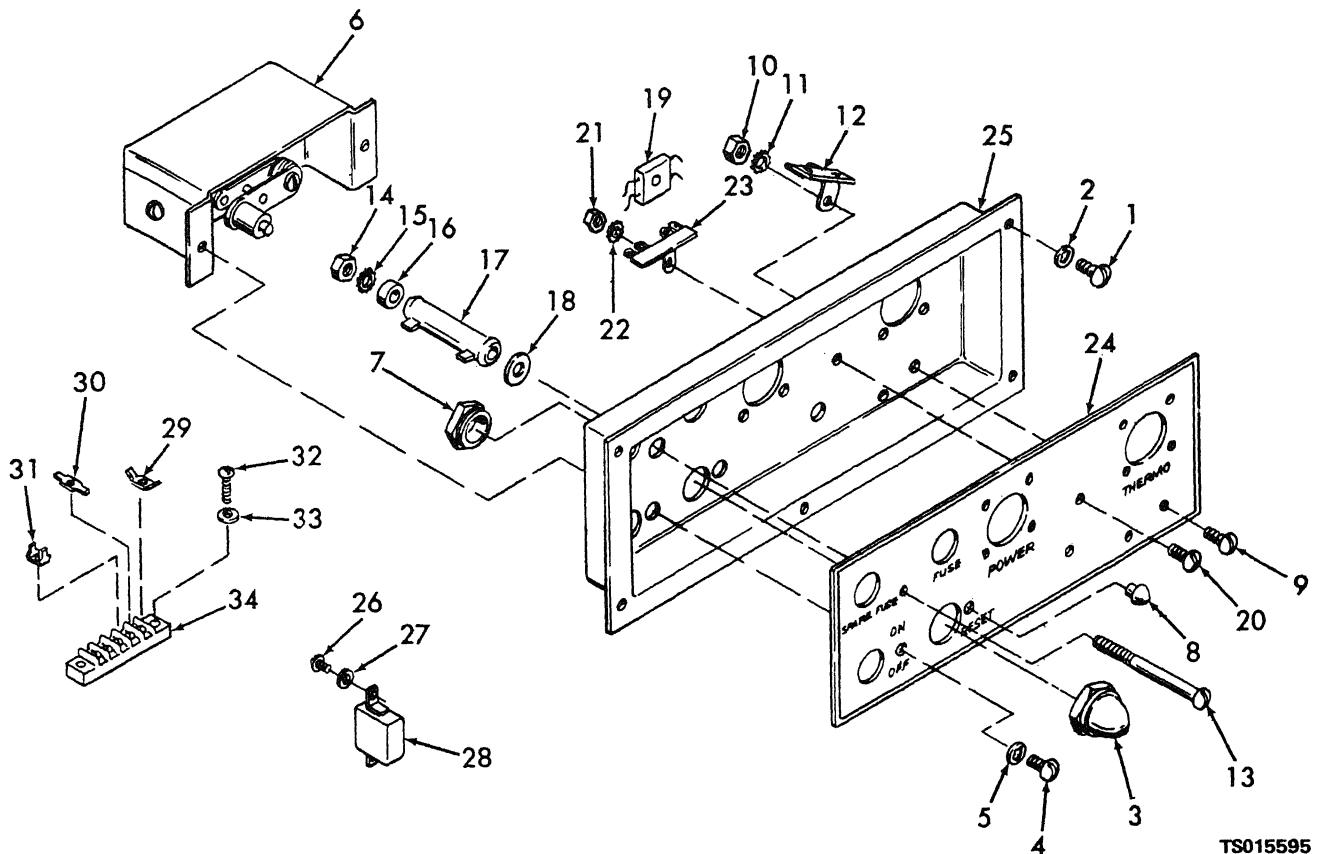
*c. Resistor.* Resistor R1 reduces the 120 volt heater power to 24 volts to energize control relay K2.

*d. Control Relay.* Control relay K2 is a 2-pole, double-throw relay which controls power to the various heater components during the stages of the heater cycle.

## 6-2. Removal and Disassembly

*a. Disconnect the power and thermostat plugs and remove the top and side cover panels (para 4-19) for access to the terminal board.*

*b. Remove the five screws (1, fig. 6-1) and lock washers (2) securing the control panel to the heater case. Pull out the control panel as far as wires will permit.*



- |                        |                    |                    |
|------------------------|--------------------|--------------------|
| 1. Screw               | 12. Terminal board | 23. Terminal board |
| 2. Lock washer         | 13. Screw          | 24. Panel plate    |
| 3. Boot                | 14. Nut            | 25. Control panel  |
| 4. Screw               | 15. Lock washer    | 26. Screw          |
| 5. Lock washer         | 16. Fiber washer   | 27. Lock washer    |
| 6. Time delay assembly | 17. Resistor       | 28. Relay          |
| 7. Nut                 | 18. Washer         | 29. Tab            |
| 8. Bumper              | 19. Rectifier      | 30. Tab            |
| 9. Screw               | 20. Screw          | 31. Tab            |
| 10. Nut                | 21. Nut            | 32. Screw          |
| 11. Lock washer        | 22. Lock washer    | 33. Lock washer    |
|                        |                    | 34. Terminal board |

Figure 6-1. Electrical control components, exploded view.

c. Refer to paragraph 4-26 for removal procedures for the ON-OFF switch, fuseholders, and receptacles.

d. Disconnect the time delay assembly leads at terminal board TB1 (fig. 1-3), and unsolder the leads at terminal board TB2, fuseholder F1, ON-OFF switch S1, and thermostat receptacle J2. Unscrew the boot (3, fig. 6-1) and remove it from the RESET switch. Remove the two screws (4) and lock washers (5) securing the time delay assembly (6) to the control panel; remove the time delay assembly.

e. If the terminal board (12) must be replaced.

unsolder the remaining leads. Remove the screw (9), nut (10), and lock washer (11) securing the terminal board to the control panel, and remove the terminal board.

f. Disconnect the two red leads from the resistor (17). Remove the nut (14), screw (13), lock washer (15), fiber washer (16), resistor (17), and washer (18) from the control panel.

## NOTE

Do not unsolder the rectifier (19) unless it must be replaced. The rectifier is easily damaged by excessive heat and cannot be repaired. Use a heat sink on the lead between the solder point and the rectifier.

g. If the rectifier (19) is defective, unsolder it from the terminal board (23). Unsolder the remaining leads from the terminal board, and remove the screw (20), nut (21), and lock washer (22) securing the terminal board to the control panel (25).

h. When control panel components have been removed, you can separate the panel plate (24) from the control panel (25) for cleaning and replacement.

i. If the control relay (28) must be replaced, unsolder the relay leads while the relay is still installed in the heater case. Remove the two screws (26) and lock washers (27) securing the relay to the bracket in the heater case, and remove the relay.

j. If the terminal board (34) must be replaced, remove the remaining leads. Note carefully the positions of the three kinds of tabs (29, 30, and 31) on the terminal board, then remove the two screws (32) and lock washers (33) and remove the terminal board from the heater case.

### 6.3. Cleaning and Inspection

#### **WARNING**

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (fed. spec. P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100 to 138 F (38 to 59 C).

a. Clean parts with a dry soft-bristle brush. Remove greasy or gummy deposits with a cloth dampened lightly in dry cleaning solvent (fed. spec. P-D-680).

b. Inspect leads and components for worn or broken insulation, signs of overheating, or other defects. Replace defective parts.

c. Test the resistor with an ohmmeter. Resistance should be 800 ohms. Replace if defective.

d. Visually inspect the heating element and contact points in the time delay unit. Replace the complete unit if the points are burned or pitted, or if the heating element is damaged. Use an ohmmeter to test continuity. There must be con-

tinuity between the blue lead and the white-black lead, and between the two red leads. There must be no continuity between the black and yellow leads, or any other pair of leads, or between any lead and the time delay assembly housing. Replace the time delay assembly if these requirements are not met.

#### NOTE

If the time delay assembly has not been removed from the control panel, the yellow, blue, and black leads must be disconnected from the terminal board before the continuity test is performed.

e. If the rectifier has not been removed from the control panel, you must disconnect it from the circuit before testing. Use a heat sink on the rectifier leads between the rectifier and the solder point when unsoldering rectifier leads. Disconnect the rectifier leads of the red and black corners of the rectifier from the terminal board. Unsolder the rectifier leads at solder lugs on the terminal board (23, fig. 6-1). Touch the test probes of an ohmmeter to the red and black rectifier leads and note the resistance. Reverse the polarity of the test probes and retest. There must be very high resistance with one polarity and low resistance with the opposite polarity. Replace the rectifier if it does not perform in this way, or if it shows signs of overheating or other damage.

#### CAUTION

The control relay is designed for 24-volt operation only. Voltage in excess of 24 volts may destroy the relay coil (terminals X1 and X2).

#### NOTE

The control relay must be disconnected from the heater circuits before performing continuity tests. Alternate circuit paths within the heater will confuse the test results.

f. Replace the control relay if the case is damaged, or if the relay shows signs of overheating or arcing. Test the resistance of the relay coil with an ohmmeter. The resistance across terminals X1 and X2 (shown in fig. 6-2) must be  $300 \pm 30$  ohms. There must be continuity only between terminals B2 and B3, and between A2 and A3. If a source of 24 vdc power is available, apply 24 volts across X1 and X2. With the relay energized, there must be continuity only across B1 and B2, and across A1 and A2. Replace the relay if it does not operate as specified.



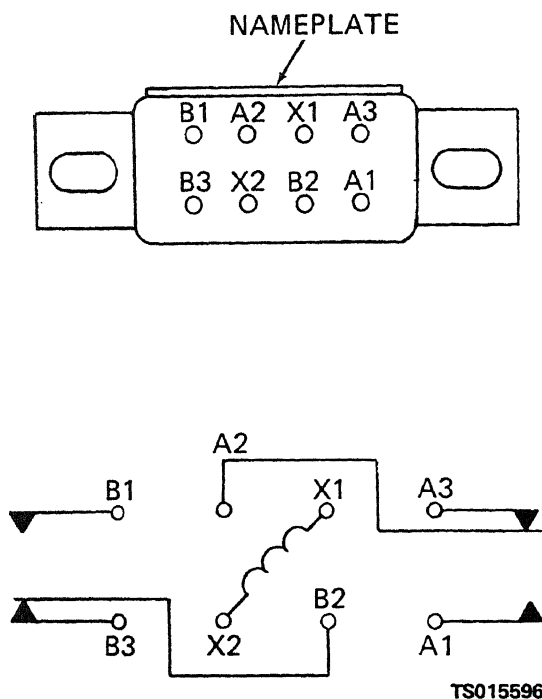


Figure 6-2. Control relay terminal identification.

g. Replace the washers (16 and 18, fig. 6-1) if they are cracked or damaged. Replace the boot (3) if it will not form a tight seal around the RESET switch. Replace all grommets and gaskets.

h. Test and inspect the ON-OFF switch,

fuseholders, and receptacles as described in paragraph 4-26.

i. Inspect all wiring for frayed or broken insulation. Replace damaged leads. Replace the terminal board if its insulation is cracked or broken.

#### 6-4. Reassembly and Installation

a. Install the components on the control panel in the reverse order of the index numbers in figure 6-1.

b. To install the rectifier on the terminal board, attach the rectifier leads to the four contacts of the terminal board so that the markings on the rectifier are visible. Interconnect the red resistor lead with one yellow rectifier lead and interconnect the white-black lead from the other terminal block to the other yellow rectifier lead. Attach the two red leads from the control relay to the contacts with the red and unmarked rectifier leads. Solder all connections with rosin-core solder.

c. Use the wiring diagram (fig. 4-11) and the control relay terminal identification illustration (fig. 6-2) as a guide when installing the leads on the control relay terminals.

d. Install the ON-OFF switch, fuseholders, and receptacles on the control panel as described in paragraph 4-26.

e. Install the control panel in the front of the heater case and secure with five screws (1, fig. 6-1) and lock washers (2).

f. Reinstall the top and side cover panels (para 4-19), connect the power and thermostat plugs, and test heater for proper operation.

## CHAPTER 7

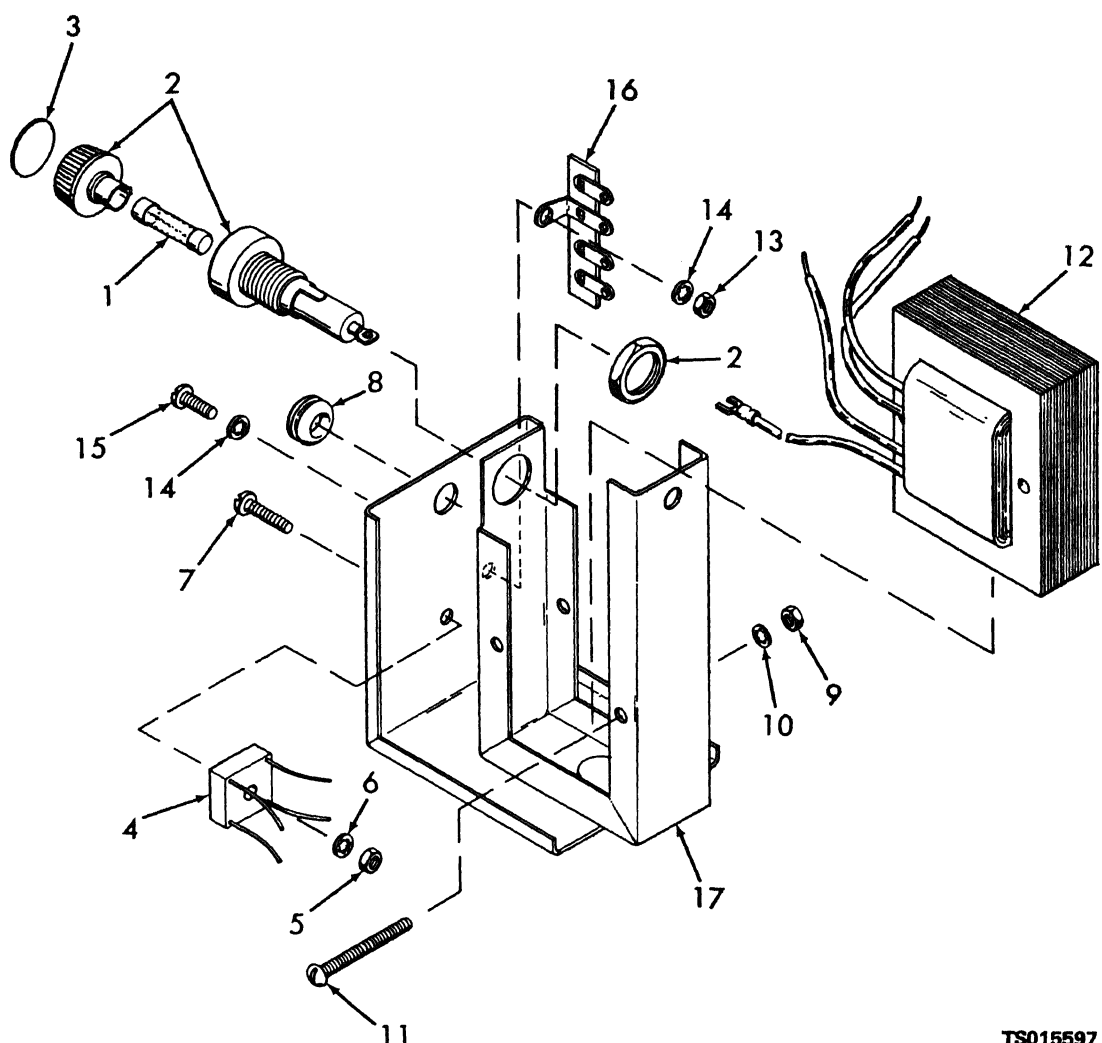
## REPAIR OF FUEL PUMP POWER SUPPLY

## 7-1. Description

The fuel pump power supply consists of fuse F2, transformer T2, and rectifier bridge CR1, shown in figure 4-11. The fuel pump power supply reduces the heater power from 120 volts to 24 volts, and changes it from ac to dc. The fuel solenoid coil and the fuel pump require 24 volt dc power.

## 7-2. Disassembly

- a. Remove the fuel pump power supply from the heater case as described in paragraph 4-30.
- b. Unscrew the cap of fuseholder (2, fig. 7-1) and remove the fuse (1). Unsolder the two black leads on the back of the fuseholder. Remove the fuseholder nut, and remove the fuseholder from the power supply case.



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- |               |                |                 |                    |
|---------------|----------------|-----------------|--------------------|
| 1. Fuse       | 5. Nut         | 9. Nut          | 13. Nut            |
| 2. Fuseholder | 6. Lock washer | 10. Lock washer | 14. Lock washer    |
| 3. Label      | 7. Screw       | 11. Screw       | 15. Screw          |
| 4. Rectifier  | 8. Grommet     | 12. Transformer | 16. Terminal board |
|               |                |                 | 17. Case           |

Figure 7-1. Fuel pump power supply, exploded view.

## NOTE

Do not unsolder the rectifier leads unless the rectifier or terminal board must be replaced. The rectifier is easily damaged by excessive heat and cannot be repaired. Use a heat sink on the rectifier lead between the rectifier and solder point.

c. If the rectifier (4) must be replaced, unsolder it from the terminal board (16). Remove the nut (5), lock washer (6), and screw (7), securing the rectifier to the case (17), and remove the rectifier.

d. Unsolder the two transformer leads from the terminal board. Feed the white-black lead through the grommet (8) in the case. Remove the two nuts (9), lock washers (10), and screws (11) securing the transformer (12) to the case, and remove the transformer.

e. If the terminal board (16) is damaged, unsolder the remaining orange lead and remove screw (15), lock washers (14), and nut (13) securing it to the case (17).

## 7-3. Cleaning and Inspection

## WARNING

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (fed. spec. P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100 to 138 F (38 to 59 C).

a. Clean the components with a cloth dampened lightly with dry cleaning solvent (fed. spec. P-D-680). Take care not to saturate electrical parts.

b. Inspect transformer for signs of overheating. Continuity must exist only between the black lead and the white-black lead, and between the two red leads. Replace a defective transformer.

c. If the rectifier (4, fig. 7-1) has not been removed from the power supply, it must be disconnected from the circuit before testing. Attach a heat sink to the rectifier leads between the solder point and the red and black corners of the rectifier. Unsolder the rectifier leads at solder lugs on the terminal board. Touch the test probes of an ohmmeter to the red and black rectifier leads and note the resistance. Reverse the polarity of the test probes and retest. There must be very high resistance indicated with one polarity and

low resistance with the opposite polarity. Replace the rectifier if it does not perform in this way, or if it shows signs of overheating or other damage.

d. Inspect the leads for frayed or broken insulation. Replace damaged leads.

e. Clean the power supply case with a clean, dry cloth or soft-bristle brush. Touch up chipped paint.

f. Replace the fuseholder if it is damaged or defective in any way.

g. Discard and replace the grommet.

## 7-4. Reassembly

a. Install the terminal board (16, fig. 7-1) in the case with screw (15), lock washers (14), and nut (13).

b. Install the transformer (12) in the case and secure with screws (11), lock washers (10), and nuts (9). Feed the white-black lead through the grommet (8) and install the grommet into the case. Connect the two red transformer leads to two ungrounded contacts on the terminal board.

c. Install the rectifier (4) in the case with its markings up, and secure with screw (7), lock washer (6), and nut (5).

## CAUTION

Use a heat sink on the leads between the rectifier and solder point when soldering rectifier leads to terminal board. Excessive heat can destroy the rectifier.

d. Solder the unmarked (—) lead of the rectifier to the grounded lug on the terminal board. Solder the power supply orange lead and the rectifier red (+) lead to the remaining ungrounded contact. Solder the two remaining yellow (ac) rectifier leads to the contacts with the two red transformer leads.

e. Install the fuseholder (2) in the case. Solder the transformer black lead and the power supply black lead to the two terminals of the fuseholder. Insert the fuse in the fuseholder and replace the cap.

f. Test the assembled power supply with a voltmeter. Connect the black and white-black leads to a source of 120-volt, 50/60-hertz power, and check for 24 vdc between the orange (+) lead and the power supply case (ground).

g. If the power supply provides the required output, install it in the heater case as described in paragraph 4-30. Test the heater for proper operation.

## CHAPTER 8

REPAIR OF BURNER AND HEAT EXCHANGER

---

## 8-1. Description

*a. Burner Head.* The burner head mounts on the end of the heat exchanger, and provides mounting for the igniter, glow plug, and carburetor. Combustion air supplied by the combustion air blower enters the burner head and passes into the burner head combustion chamber, where it mixes with the fuel from the carburetor. This mixture is ignited and burns within the burner head.

*b. Heat Exchanger.* The heat exchanger is a stainless steel cylinder with a large surface area. It is open to the burner head at one end, and contains an outlet for exhaust gases near the other end. The burning fuel and air mixture heats the walls of the heat exchanger. The ventilation air blower blows circulating air around the outside of the heat exchanger, where the air picks up heat from the heat exchanger before it passes through the warm air louver into the enclosure to be heated.

## 8-2. Removal and Disassembly

*a.* Disconnect the power and thermostat plugs. Disconnect the fuel supply and the exhaust piping. Remove the top and side cover panels and warm air louver (para 4-19).

*b.* Remove the carburetor from the burner head (para 4-23).

*c.* Remove the igniter and glow plug from the burner head, and remove the thermocouple and grommet from the heat exchanger and housing (para 4-35). Remove the combustion air hose from the combustion air blower and burner head (para 4-35).

*d.* Remove the screws (1, fig. 8-1) and lock washers (2) securing the burner head (3) to the heat exchanger housing (24). Remove the burner head and gasket (4).

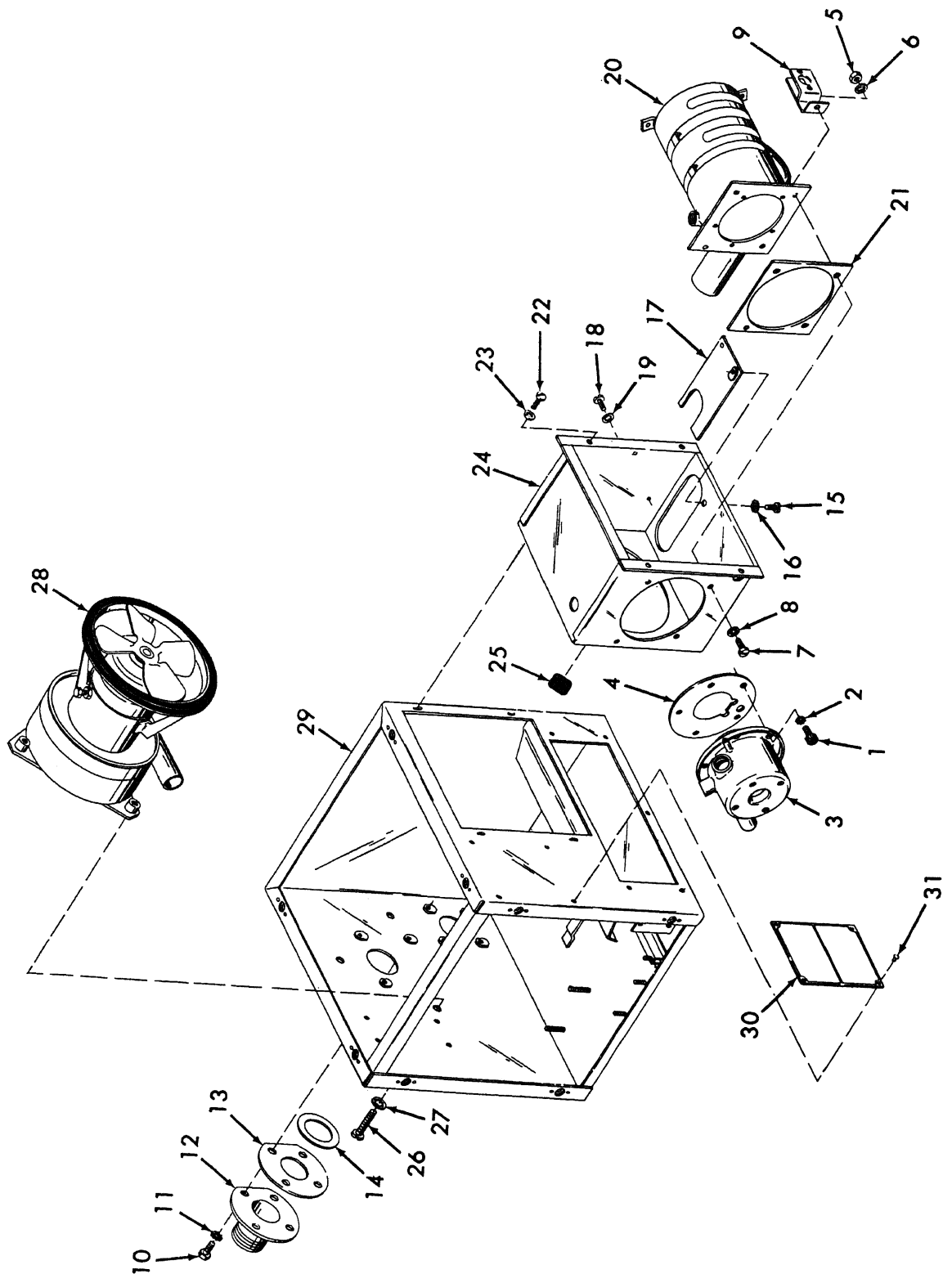


Figure 8-1. Burner, heat exchanger, and blower installation, exploded view.

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## KEY to fig. 8-1:

- |                        |                            |
|------------------------|----------------------------|
| 1. Screw               | 17. Plate                  |
| 2. Lock washer         | 18. Screw                  |
| 3. Burner head         | 19. Lock washer            |
| 4. Gasket              | 20. Heat exchanger         |
| 5. Nut                 | 21. Gasket                 |
| 6. Lock washer         | 22. Screw                  |
| 7. Screw               | 23. Lock washer            |
| 8. Lock washer         | 24. Heat exchanger housing |
| 9. Bracket             | 25. Tubing                 |
| 10. Screw              | 26. Screw                  |
| 11. Lock washer        | 27. Lock washer            |
| 12. Exhaust connection | 28. Blower assembly        |
| 13. Gasket             | 29. Heater case            |
| 14. Exhaust washer     | 30. Data plate             |
| 15. Screw              | 31. Rivet                  |
| 16. Lock washer        |                            |

e. Remove the overheat thermostat (para 4-29). Remove the nut (5), lock washers (6 and 8), and screw (7) securing the bracket (9) to the housing (24); remove the bracket.

f. Remove the four screws (10) and lock washers (11) securing the exhaust connection (12) to the heater case. Remove the exhaust connection, gasket (13), and exhaust washer (14).

g. Remove the screw (15) and lock washer (16) from the underside of the housing (24) and remove the plate (17). Remove the five screws (18) and lock washers (19) securing the heat exchanger (20) to the housing. Pull the heat exchanger up and out to remove it, and remove the gasket (21).

h. Remove the four screws (22) and lock washers (23) securing the housing (24) to the heater case (29). Pull out the housing to remove it from the case. Remove the four pieces of rubber tubing (25) from the back of the housing.

i. If the data plate (30) is damaged, drill out the four rivets (31) and remove the data plate from the heater housing.

### 8-3. Cleaning and Inspection

#### **WARNING**

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (fed. spec. P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100 to 138 F (38 to 59 C).

a. Clean all metal parts except the overheat thermostat in dry cleaning solvent (fed. spec. P-D-680), using a wire brush to remove deposits from the heat exchanger and burner head. If necessary, use compressed air to dry out solvent from the inside of the heat exchanger before reinstalling it in the heater.

#### **WARNING**

The heat exchanger confines the combustion gases and directs them to the exhaust pipe. It must be air tight to prevent harmful combustion products from entering the heated enclosure. Any crack or hole through the exchanger walls requires exchanger replacement.

b. Inspect the heat exchanger and its exhaust pipe for cracks, breaks, holes, excessive corrosion and other damage. Replace a damaged heat exchanger.

c. Inspect the exchanger housing for distortion, corrosion, and other damage. Small dents or holes in the housing may be repaired as necessary, but if the blower, burner head, or heat exchanger does not seat properly on the housing, you must replace the housing.

d. Inspect the burner head for cracks, breaks, holes, and distortion. Check that the threads in the igniter and glow plug mounting holes are not damaged. Replace a damaged burner head.

e. Discard and replace the gaskets (4, 13, and 21). The exhaust washer (14) may be reused if it is not distorted, compressed, or damaged.

### 8-4. Installation

a. Install the heat exchanger and burner head in the heater case in the reverse order of the index numbers in figure 8-1.

b. Install the thermocouple in the heat exchanger using a new grommet (12, fig. 4-12). Install the igniter, glow plug, and combustion air hose as described in paragraph 4-35.

c. Install the carburetor on the burner head. Refer to paragraph 4-23.

d. Connect the exhaust piping, making sure it meets the specifications given in paragraph 4-3. Install the cover panels and warm air louver (para 4-19).

e. Connect the power and thermostat plugs, and turn on the fuel supply. Test the heater for proper operation.

## CHAPTER 9

### REPAIR OF BLOWER ASSEMBLY

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#### 9-1. Description

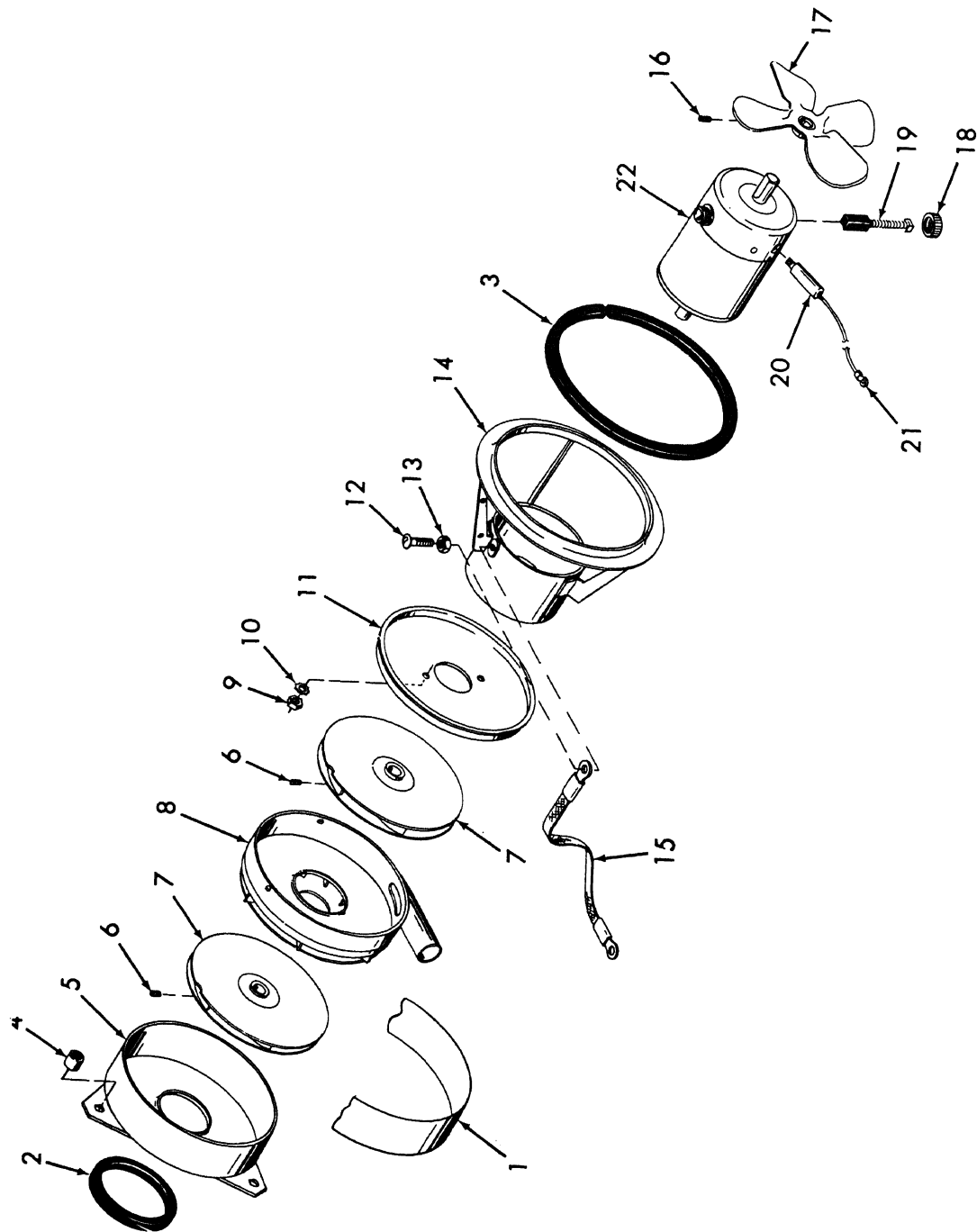
The blower assembly consists of a 120-volt motor and three impeller assemblies (7 and 17, fig. 9-1). The dual combustion air impellers (7), located at the rear of the motor, provide air under slight pressure for combustion only. Combustion air is ducted through the combustion air hose to the burner head. Ventilation air is circulated around the outside of the heat exchanger by the ventilation air impeller (17). This heated air passes through the warm air louver to heat the enclosure.

#### 9-2. Removal and Disassembly

a. Refer to paragraph 8-2 and remove the burner head and heat exchanger.

b. Disconnect the gray motor lead at the plug-in connector, and disconnect the white-black lead at the terminal board. Disconnect the motor ground strap at the fuel pump mounting stud as shown in figure 4-6. Remove the three screws (26, fig. 8-1) and lock washers (27) securing the blower assembly (28) to the heater case. Remove the blower assembly.

c. Remove and discard the sealing tape (1, fig. 9-1). Use a file or punch to mark the blower housing (5), fan and tube (8), and back plate (11) to indicate correct alignment of these parts for reassembly. Remove the shroud gasket (3) and housing gasket (2).



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Figure 9-1. Blower assembly, exploded view.

## KEY to fig. 9-1:

- |                   |                           |
|-------------------|---------------------------|
| 1. Sealing tape   | 12. Screw                 |
| 2. Housing gasket | 13. Nut                   |
| 3. Shroud gasket  | 14. Motor mount           |
| 4. Shock mount    | 15. Ground strap          |
| 5. Blower housing | 16. Setscrew              |
| 6. Setscrew       | 17. Impeller              |
| 7. Impeller       | 18. Brush cap             |
| 8. Fan and tube   | 19. Brush                 |
| 9. Nut            | 20. Suppression capacitor |
| 10. Lock washer   | 21. Lead                  |
| 11. Back plate    | 22. Motor                 |

d. Remove the shock mounts (4) from the blower housing (5), and pull off the blower housing to remove it. Loosen the setscrew (6) in the outer impeller (7), and remove the impeller from the motor shaft. Pull off the fan and tube (8).

e. Loosen the setscrew (6) securing the inner impeller (7) to the motor shaft, and remove the impeller. Remove the two nuts (9) and lock washers (10) securing the back plate (11) to the motor, and remove the back plate.

f. Loosen the nuts (13) and back out the screws (12) securing the motor assembly (22) to the motor mount (14). Slide out the motor to remove it. If the ground strap (15) is damaged, completely remove the screw (12) securing the strap to the motor mount, and remove the ground strap.

g. Loosen the setscrew (16) securing the impeller (17) to the motor shaft, and remove the impeller. Remove the brush caps (18) and brushes (19).

h. If the suppression capacitors (20) must be replaced, unscrew them from the motor. Unsolder the motor leads (21) from the capacitors.

### 9-3. Cleaning and Inspection

#### **WARNING**

Clean parts in a well-ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Dry cleaning solvent (fed. spec. P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100 to 138 F (38 to 59 C).

a. Wipe the exterior of the motor assembly with a cloth dampened with dry cleaning solvent (fed. spec. P-D-680). Prevent solvent from entering the motor.

b. Clean metal parts in dry cleaning solvent and allow to dry thoroughly before reassembly.

c. Inspect the impellers for bent or broken blades or other damage. Replace damaged impellers.

d. Inspect the blower housing, fan and tube, back plate, and motor mount for distortion, broken welds, and other damage. Replace defective parts.

e. Remove and inspect the motor brushes for cracks, chips, wear, or scoring. Replace brushes if damaged or if they are worn to less than 5/16 inch (7.9375 mm). Inspect the condition of the motor commutator while the brushes are removed. Replace the motor if the commutator is scored or badly burned. Visually inspect the motor for signs of overheating or other damage. Spin the motor shaft and check for binding and for wobbling of the shaft, which indicate worn or defective bearings. Replace a worn, damaged, or defective motor.

f. Inspect suppression capacitors for burned or broken insulation or other damage. If a capacitance tester is available, test the capacitors. Capacitance should be 0.015 microfarad. Replace a defective capacitor.

g. Discard and replace the sealing tape (1) and gaskets (2 and 3). Replace the shock mounts (4) if they are worn or damaged.

### 9-4. Reassembly and Installation

a. Reassemble the blower assembly in the reverse order of the index numbers in figure 9-1. Be sure to use new gaskets.

b. Line up the alignment marks on the back plate (11), fan and tube (8), and blower housing (5) before sealing the assembled blower with tape (1).

c. Use rosin-core solder when soldering the leads to the suppression capacitors (20).

d. Install the blower assembly in the heater case as shown in figure 8-1. Secure with the attaching screws (26) and lock washers (27).

e. Connect the white-black motor lead to the terminal board, and connect the gray lead to the plug-in connector as shown in the wiring diagram (fig. 4-11). Connect the motor ground strap to the fuel pump mounting stud, and secure it with the attaching nut and lock washer.

f. Install the burner and heat exchanger described in paragraph 8-4. Test heater operation after reassembly.

## CHAPTER 10

### ADMINISTRATIVE STORAGE

---

#### 10-1. General

For general administrative storage instructions, refer to TM 740-90-1. Specific administrative storage instructions for Heater, Model UH-48C, Type I, are provided in paragraph 10-2.

#### 10-2. Administrative Storage Instructions

a. Disconnect the fuel line from the fuel connector. Start the heater and allow it to run until it stops from lack of fuel. This will purge fuel from fuel lines.

b. Remove thermostat and also disconnect the thermostat leads and power cables on the control panel.

c. Remove, drain, and reinstall the fuel bowl of the fuel strainer.

d. Disconnect the exhaust pipe from the exhaust connector.

e. Remove bolts securing heater to the base of floor.

f. Tape fuel, combustion air, and exhaust openings to prevent entry of moisture and dirt.

g. Store heater in a dry, protected location. If necessary, protect it from moisture, dust, and dirt by inserting the heater into a polyethylene bag and sealing the bag with moisture-proof tape.

h. If there are possibilities that the heater may be bumped or otherwise mishandled in storage, construct a wooden box large enough to install the heater with enough resilient packing to minimize damage that might be caused during storage. Use vapor barrier materials as required by conditions at the storage site.

i. Inspect the heater in storage as required by current directives.

## APPENDIX A

### REFERENCES

---

- A-1. Fire Protection**  
TM 5-4200-200-10      Hand Portable Fire Extinguishers for Army Users.
- A-2. Painting**  
TM 9-213      Painting Instructions for Field Use
- A-3. Maintenance**  
DA Pam 738-750      The Army Maintenance Management System  
TM 5-4520-239-24P      Organizational, Direct and General Support Repair Parts and Special Tools List.
- A-4. Shipment and Storage**  
SB 740-4520-97-E01      Storage Serviceability Standard for Heaters  
SB 38-100      Army Preservation, Packing, and Marking Materials, Supplies and Equipment  
TM 38-230-1      Preservation and Packing of Military Equipment  
TM 740-90-1      Administrative Storage of Equipment
- A-5. Demolition**  
TM 750-244-3      Destruction of Material to Prevent Enemy Use
- A-6. Radio Suppression**  
TM 11-483      Radio Interference Suppression
- A-7. Fuels, Lubricants, Oils, and Waxes**  
C9100IL      Identification List for Fuels, Lubricants, Oils, and Waxes.

## MAINTENANCE ALLOCATION CHART

## Section I. INTRODUCTION

## B-1. General

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance levels.

b. Section II designates overall responsibility for the performance of maintenance functions on the identified end item or component and the work measurement time required to perform the functions by the designated maintenance level. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance functions.

c. Section III lists the tools and test equipment required for each maintenance function as referenced from Section II. (Not applicable).

## B-2. Explanation of Columns in Section II

a. *Column (1). Group Number.* Column 1 lists group numbers to identify related components, assemblies, subassemblies, and modules with their next higher assembly. The applicable groups are listed in the MAC in disassembly sequence beginning with the first group removed.

b. *Column (2). Component/Assembly.* This column contains the noun names of components, assemblies, subassemblies and modules for which maintenance is authorized.

c. *Column (3). Maintenance Functions.* This column lists the functions to be performed on the item listed in Column (2). The Maintenance Functions are defined as follows:

1. *Inspect.* To determine serviceability of an item by comparing its physical, mechanical, and electrical characteristics with established standards through examination.

2. *Test.* To verify serviceability and detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

3. *Service.* Operations required periodically to keep an item in proper condition, i.e., to clean (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

4. *Adjust.* To maintain within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to specified parameters.

5. *Align.* To adjust specified variable elements of an item to bring about optimum or desired performance.

6. *Calibrate.* To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipments used in precision measurement. Consists of comparison of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

7. *Install.* The act of emplacing, seating, or fixing into position an item, part or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

8. *Replace.* The act of substituting a serviceable like type part, sub-assembly, or module (component or assembly) for an unserviceable counterpart.

9. *Repair.* The application of maintenance services (inspect, test, service, adjust, align, calibrate, or replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

10. *Overhaul.* That maintenance effort (Service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e., DMWR) in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to a like new condition.

11. *Rebuild.* Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild

is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours/miles, etc.) considered in classifying Army equipment/components.

d. *Column (4). Maintenance Category.* This column is made up of sub-columns for each category of maintenance. Work time figures are listed in these sub-columns for the lowest level of maintenance authorized to perform the function

listed in Column (3). These figures indicate the average active time required to perform the maintenance function at the indicated category of maintenance under typical field operating conditions.

e. *Column (5). Tools and Equipment.* This column is provided for referencing by code, the common tool sets (not individual tools) special tools, test and support equipment required to perform the designated function (Not applicable).

## Section II. MAINTENANCE ALLOCATION CHART

(1)	(2)	(3)	(4)					(5)
Group number	Component / assembly	Maintenance function	Maintenance category					Tools and equipment
			C	O	F	H	D	
01	HEATER ASSY							
	Cover panels	Inspect	0.1					
		Service		0.1				
		Replace		0.1				
	Housing	Inspect	0.1					
		Service		0.1				
	Data plates	Inspect	0.1					
		Replace			0.3			
	Louver	Inspect	0.1					
		Service		0.1				
02	CONTROL PANEL ASSY	Replace		0.1				
		Repair			1.0			
	Switch-on-off	Inspect		0.1				
		Replace		0.2				
	Time Delay and Reset Assy	Inspect			0.2			
		Test			0.2			
		Replace			0.3			
	Fuse	Replace		0.1				
	Receptacle	Replace		0.3				
	Connector	Replace		0.1				
03	FUEL SYSTEM							
	Fuel Pump	Replace		0.2				
	Filter	Service		0.2				
		Replace		0.2				
	Fuel Filter	Replace		0.1				
	Filter	Service		0.1				
		Replace		0.1				
	Fuel Lines and Fittings	Inspect		0.1				
		Replace		0.1				
	Carburetor Assy	Replace		0.2				
04	ELECTRICAL							
	Wiring Harness	Inspect		0.1				
		Replace				0.5		
		Repair			0.5			
	Motor Power	See Blower Assembly						
	Thermistor	Replace		0.2				
	Ignition	See Blower Assembly						

\* SUBCOLUMNS ARE AS FOLLOWS:  
F—DIRECT SUPPORT

C—OPERATOR, CREW;  
H—GENERAL SUPPORT;

O—ORGANIZATIONAL;  
D—DEPOT

\* SUBCOLUMNS ARE AS FOLLOWS:

F—DIRECT SUPPORT

\* \* INDICATES WT / MH

C—OPERATOR, CREW;  
H—GENERAL SUPPORT;

O—ORGANIZATIONAL;  
D—DEPOT



(1)	(2)	(3)	(4)					(5)				
Group number	Component / assembly	Maintenance function	Maintenance category					Tools and Equipment				
			C	O	F	H	D					
04	ELECTRICAL—Continued Thermo couple  Overheat, Thermostat  Preheat, Thermostat  Control Relay   Transformer with Ignition Cable  Thermostat, Room  Power Supply, Fuel Pump	Inspect Service Replace Inspect Replace Inspect Replace Inspect Test Replace Inspect Replace Adjust Replace Replace	0.1	0.1								
				0.1								
				0.1								
				0.1								
				0.1								
				0.1								
				0.1								
				0.2								
				0.2								
				0.1								
				0.1								
				0.2								
				0.1								
				0.2								
				0.1								
				0.2								
				05	BURNER ASSY Burner Head  Hose, Air  Igniter  Glow Plug	Inspect Service Replace Inspect Replace Inspect Replace Inspect Replace	0.1	0.1				
								0.1				
0.2												
0.1												
0.1												
0.1												
0.1												
0.1												
0.1												
0.1												
0.1												
0.1												
06	HEAT EXCHANGER	Inspect Replace	0.1	0.1								
				0.1								
07	BLOWER ASSY Motor Brushes  Bearings Fan Capacitor	Replace Replace Inspect Replace Inspect Inspect Replace	0.1	0.2								
				0.2								
				0.1								
				0.1								
				0.5								
				0.5								
				0.2								
				0.2								

\* SUBCOLUMNS ARE AS FOLLOWS:  
F—DIRECT SUPPORT;  
\*\* INDICATES WT / MH REQUIRED

C—OPERATOR / CREW;  
H—GENERAL SUPPORT;

O—ORGANIZATIONAL;  
D—DEPOT

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## W

By Order of the Secretary of the Army:

FRED C. WEYAND  
*General, United States Army*  
*Chief of Staff*

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*The Adjutant General*

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Operator's Maintenance requirements for HEATERS, SPACE, 15,000 BTU.

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# SOMETHING WRONG WITH THIS MANUAL?

THEN... JOT DOWN THE DOPE ABOUT IT ON THIS FORM, TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL!

FROM: (YOUR UNIT'S COMPLETE ADDRESS)

PFC JOHN DOE  
CoA, 3<sup>d</sup> ENGINEER BN  
FT. LEONARD WOOD MO 63108

DATE

16 DEC 74

PUBLICATION NUMBER

TM 5-6115-200-20 AND P

DATE

1 APR 72

TITLE

GENERATOR SET 10 KW  
NSN 6115-00-231-7286

BE EXACT... PIN-POINT WHERE IT IS

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

PAGE NO.

PARA-GRAPH

FIGURE NO.

TABLE NO.

6

2-1  
a

In line 6 of paragraph 2-1a the manual states the engine has 6 cylinders. The engine on my set only has 4 cylinders. Change the manual to show 4 cylinders

81

4-3

Callout 16 on figure 4-3 is pointing at a bolt. In the key to fig. 4-3, item 16 is called a shim. Please correct one or the other.

125 line 20

I ordered a gasket, item 19 on figure B-16 by NSN 2910-00-762-3001. I got a gasket but it doesn't fit. Supply says I got what I ordered so the NSN is wrong. Please give me a good NSN

TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER

JOHN DOE, PFC (268) 317-7111

SIGN HERE:

John Doe

DA FORM 1 AUG 74 2028-2 (TEST)

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR MANUAL "FIND," MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

FILL IN YOUR  
UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

OFFICIAL BUSINESS

Commander  
U.S. Army Troop Support Command  
ATTN: AMSTS-MPP  
4300 Goodfellow Boulevard  
St. Louis, Missouri 63120

TEAR ALONG DOTTED LINE

FOLD BACK

# SOMETHING WRONG WITH THIS MANUAL?



THEN...JOT DOWN THE  
DOPE ABOUT IT ON THIS  
FORM, TEAR IT OUT, FOLD  
IT AND DROP IT IN THE  
MAIL!

FROM: (YOUR UNIT'S COMPLETE ADDRESS)

DATE

PUBLICATION NUMBER

DATE

TITLE

BE EXACT. . .PIN-POINT WHERE IT IS

IN THIS SPACE TELL WHAT IS WRONG  
AND WHAT SHOULD BE DONE ABOUT IT:

PAGE  
NO.

PARA-  
GRAPH

FIGURE  
NO.

TABLE  
NO.

TEAR ALONG DOTTED LINE

TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER

SIGN HERE:

DA FORM 2028-2 (TEST)

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TEAR ALONG DOTTED LINE